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PADDY CULTIVATION IN CEYLON.

Peradeniya, February 15, 1914.

To judge by what has recently been written in connection with this subject, it might be supposed that nothing has yet been attempted in the direction of improving the methods of paddy cultivation in this Island. An examination of the records of the Department of Agriculture, the Ceylon Agricultural Society, and the pages of the TROPICAL AGRICULTURIST reveal the fact that a great deal of investigations has been carried out and useful data obtained, and before further steps are taken in the matter it is manifestly desirable that we should ascertain the ground that has been covered. This is to be done and a bulletin on the subject issued by the Department of Agriculture as soon as it can be prepared.

The question of paddy cultivation in this Island may be considered from several points of view, first that of the extension of the area under the crop. In 1908 the area under paddy was 640,607 acres; in 1910-11 it had risen to 680,604 acres; it dropped again to 644,763 acres in 1911-12. A Sub-Committee appointed by the Committee of the Planters' Association to go into the cooly food supplies stated in their report presented on the 9th January 1914 that the loss on rubber and tea estates in 1913 due to the rise in the price of rice issued to coolies was Rs. 2,150,004, and it would appear that the Sub-Committee was

of opinion that this loss could be saved if the area of cultivation in Ceylon were increased. We are by no means sure of this unless it were very greatly increased, the Ceylon contribution to the total production of the East being small.

In the sphere of experiment much no doubt awaits investigation. It is a well known fact that a field of transplanted paddy will give a heavier crop than one on which the seed has been broadcasted, and that being so no useful purpose is served by conducting experiments to prove it over again. But it does not follow that transplanting even though productive of bigger crops is always desirable. Wheat is the crop that tillers like paddy but even if transplanting gave five-fold the crop of drilling, the wheat growers of Canada and Australia, for example, could never adopt the practice because of the labour involved. Similarly circumstances in Batticaloa may be unsuitable for transplanting.

In the Kandy district where transplanting is practised and in others where it is likely to be adopted, spacing experiments should be conducted. The custom generally is to put 4 plants into each hole at distances of from 4 to 6 inches apart but this custom is, in some localities, gradually giving way to the better method of planting one or two plants together 6 by 6 or 9 by 9 with greater economy of seed and labour. The aim should be to stretch this spacing as much as possible by selecting seed from good tillering plants and by the introduction of new strains.

In the case of wet paddy it is obvious that the question of manuring is beset with complications from which ordinary dry land crops are free. Very soluble manures like Nitrate of Soda are liable to be washed away to the next man's field below or the channel further on. Plants like paddy that feed in water-logged land may require their nitrogen in a combination peculiar to their needs. Experiments with green manures are of recent introduction in Ceylon and we have as yet no reliable data in support of the expectation, certainly a reasonable one, that growing green crops between the paddy crops will tend to enrich the soil and improve its texture.

In 1910 one hundred iron ploughs were in use at Tissa the locality in which, thanks to the influence of MR. WOLFE at that time Assistant Government Agent of Hambantota, most progress

had been made in the introduction of new implements. As far as we can ascertain 26 of these ploughs are now in use. This points to the popularity of the modern iron plough having waned. Generally speaking, the preparation of the land for the paddy crop is an elaborate and highly specialised process, and our hopes of being able to improve upon the implements employed are not of a sanguine character.

In the foregoing we have touched upon some of the problems with which this paddy question is faced; but there are of course others. None of the expedients we are accustomed to use with field experiments will ever avail with one of these problems, because paddy growing is something more than an industry in Ceylon; it is a religion with a liturgy. The cultivator is governed throughout by ceremonial designed to placate the powers concerned. "First of all," writes a correspondent, "the goiya who lives on his ancestral lands, presents himself before the Neketrala (or the village astrologer) with the customary offering of forty leaves of betel-pepper and expresses his wishes in a very polite manner. The way in which he expresses his wishes is by handing over the betel leaves with both his hands, and then folding his hands together bowing down at the same time. The Neketrala, after some astrological calculations, informs his petitioner of the circumstances leading to the success or failure of his undertaking. On a day that may be appointed by the Neketrala, the goiya makes his way towards the field with a hoe turning his face towards the favourable direction of the horizon, as indicated by the astrologer. This Neketa (auspicious day), is for the clearing up of jungle growth from the neighbouring land, and for the opening up of drains, channels and water-courses." And so on through ploughing, transplanting and harvesting. All this may not be business, but it must be considered when dealing with the subject.

R. N. L.

RUBBER.

GRENIER'S RUBBER ANNUAL.

We have received a copy of GRENIER'S RUBBER ANNUAL, a most interesting publication giving an account of the Rubber Industry as it exists to-day in many of the leading plantations of the Federated Malay States. Those interested in this absorbing topic could not do better than secure a copy of this annual which indeed we regard as indispensable in the files of the Office or the Library.

MANIHOT DICHOTOMA SHOWING THE EFFECT OF CLOSE AND WIDE PLANTING 6 ft. × 6 ft. and 12 ft. × 12 ft.

This variety was obtained from Brazil about 1910 and was strongly recommended. Its growth, however, has been very disappointing, the yield being too small to be remunerative.

The branches are very brittle and liable to be broken by wind or heavy rain when the trees are in full foliage.

The trees planted 6 ft. by 6 ft. made a better stand, but the growth was much smaller and very unsatisfactory.

The planting of this variety cannot be recommended.

MANIHOT GLAZIOVII IN THE BELGIAN CONGO.

A. JACQUES.

Until recently the culture of Manihot has been neglected in the Belgian Congo. In 1911 only two or three small plantations existed, possessing between them some thousands of trees. The writer gives figures showing results obtained in this region with *Manihot Glaziovii*. A tree six years old

planted in good soil yields an average of 2 lb. of dry rubber per annum. The yield increases rapidly with the age of the trees until it reaches 5 or 6 lb. at the age of 8 or 9 years. With hand labour it is possible to establish and maintain a plantation of 1,000 ha. (2,470 acres), containing 1,200,000 trees; until the trees come into bearing with a capital of 2 million francs (£80,000).

The present price of Manihot rubber on the Antwerp market is under 9*d.* per lb. In the event of a further decrease in the price of rubber, plantations of 3 and 4 years growth could be left without cultivation for several years until the price recovered.—MONTHLY BULLETIN.

FUNTUMIA ELASTICA
IN WEST AFRICA.

A. CHEVALIER.

The MONTHLY BULLETIN for December last contains the following account which has been summarised from the JOURNAL D'AGRICULTURE TROPICALE :—

Funtumia elastica is the only tree indigenous to Africa which yields a good quality of rubber. Although it has been cultivated for nearly 30 years we still know very little of its biological peculiarities. The writer summarises the observations he has made amongst the natives. These are of great importance, and the conclusions to be drawn from them will serve as a basis for the constitution of new plantations.

Trees which are allowed to develop surrounded by dense undergrowth have long clean stems and appear more suitable for latex production. On the other hand, trees planted in clearings and well-kept plantations develop a thick stunted growth and a short, much branched trunk. They mature earlier but yield less latex.

The writer reviews the results obtained in the principal Colonies where *Funtumia* is cultivated, viz., the Gold Coast, S. Nigeria, the Belgian and French Congo. He then gives some interesting details of the plantation at Bokoné (Gaboon). In 1906 some trees were planted 12 feet by 12 feet and others 10 feet by 7 feet. In both cases the development of the trees was normal. At the end of 6 years they reached a height of from 30 feet to 35 feet with clean trunks from 15 feet to 20 feet in length. The author attributes this fine growth to close planting, as the soil was of quite average fertility.

In one portion of the plantation the branches were destroyed by a fungus disease. With a view to promoting a rapid and straight growth in the new shoots it seemed desirable to allow the natural growth to spring up round the trees, especially that of Musangas, which shoots up very rapidly. The half etiolated shoots of *Funtumia* grew up with the Musangas, and the latter were not cut down until the new shoot had reached a suitable development.

THINNING OUT RUBBER.

MR. G. A. TALBOT, at the Kintyre Meeting, criticised the retrograde views of well-known Ceylon experts on the subject in the following remarks :—

"Turning to rubber, the crop has increased from 60,691 lb. to 82,867 lb., being an all round yield of 140 lb. an acre against 111 last year. This yield is a small one, partly owing to many of the fields being in partial bearing, and partly to the bark being thin, owing to the trees being closely planted. The closely planted fields are now being thinned, but it will take a little time for the trees to attain the spread that is necessary to give thick bark, and a good renewal. In this matter of close planting and thinning, I must say I think our expert advisers in Ceylon have been slow to recognise the necessity of giving trees greater space to develop a good head of leaves; it is some time ago since I drew their attention to this, after visiting rubber estates in Ceylon, but it is only lately that systematic thinning has been taken in hand. . . . . The season is unfortunate. . . . . and the rubber trees are only in partial bearing and have to be nursed into a full yielding capacity by thinning.

"They might look forward to a reduction in the cost of producing their rubber and there was a possibility of getting their costs down to 1*s.* 2*d.* per lb. In thinning out the rubber trees, it was their object to get about 100 trees to the acre finally. There had been great difficulty in getting those in Ceylon to fall in with their views as to thinning out rubber trees. Planters do not like to sacrifice a tree that was seemingly growing well and producing bark and latex. It would not be possible when they reduced the rubber fields to 100 trees per acre, to interplant again with tea: the rubber grew very much better when the tea was cut out. They might, moreover, in time find that even 100 trees to the acre were too many."

The F. M. S. report contains instructive lessons as to the advantages resulting from thinning out. We may commend them to DR. BERKHOUT and any of this gentleman's disciples. The report first states that the average annual yield per tree has risen from 2·49 to 3·06 lb., and the average yield per acre from 227 lb. to 310 lb. These figures refer to the whole area in bearing. Certain sections of the oldest plantations gave still larger yields than previously. A section consisting of 48¾ acres for example on the West Country gave a yield of 653 lb. per acre, while the largest yield per tree was also obtained on the same division, viz., an average yield of 16·45 lb. per tree from a section consisting of 730 trees. Then follows an instructive paragraph on thinning out :—

"These heavy yields, and indeed, all the best averages were obtained from sections, where owing to progressive thinning out, there is plenty of space between the trees. We informed you last year of the satisfactory results obtained by such thinning out and these are confirmed by this year's experience. By our Agents' advice, we decided to extend the system throughout the plantations and according to the late advices almost the whole of the estates should by now be thinned out to about 80 trees an acre, while some of the oldest portions have been reduced to as few as 60 or 70. The advantages with this system are more space for the roots and branches of the trees, a quicker and better bark renewal, a saving on the cost of collection owing to the larger yield per acre, and a reduction in the number of tapping coolies. Our Agents expect that when the full effect of the thinning out is felt, the yield per acre will still further improve."—GRENIER'S RUBBER NEWS.

COAGULATION OF HEVEA LATEX BY SMOKE.

V. CAYLA.

The writer states that plantation rubber has not yet been made equal in quality to that of "Up-river Fine Hard Para," the superior quality of which is attributed to the Amazonian smoking methods. He believes that the chemical composition of the smoke used on the Amazon has no such special action that other materials cannot be used for burning, but that the physical and mechanical conditions of coagulation and drying determine the ultimate quality of the rubber.

MECHANICAL EFFECTS.—The layers of rubber coagulated by smoking are very different in quality from that of the commercial product. The coagulum is of a creamy white colour, of medium elasticity and considerable plasticity. Its physical constitution is gradually changed and its volume reduced; water is given off and it darkens until it becomes black outside. This slow contraction continues for days and even weeks. In this way is effected spontaneously that work that is done by machinery in the plantation factories. The coagulation of the latex in successive layers favours this spontaneous contraction, as each layer increases the compression of the inner layers.

The writer believes that the superiority of the spontaneous contraction of the Amazonian rubber over the mechanical pressing of the plantation product lies in its slow, regular and continuous action, which has a very important effect on the quality of the rubber.—MONTHLY BULLETIN.

FRUIT CULTIVATION.

AGRICULTURE.—Recent correspondence in the press would appear to indicate that little is known of the Society's efforts to improve and extend fruit culture in the Island. In the last Progress Report reference was made to the distribution of a consignment of grafted fruit plants from Bangalore. This is only one of a series of half-yearly records which show that the Society has imported and distributed some thousand of fruit grafts. At the same time the orchard at Bandaragama, the mixed fruit gardens at Weragoda, Kegalle, Dedigama, Pindeniya, &c., and the sections devoted to fruit in School Gardens contribute in no small measure to the improvement and extension of the industry. The co-operation of members, which is one of the chief benefits accruing from an Agricultural Society, has an important bearing upon this work.

LAC CULTURE.

Samples of Indian lac produced on MR. K. BANDARA-BEDDEWELA'S estate near Kandy have been forwarded to the Museums in Colombo and Peradeniya. The Secretary of the Kandy Art Museum reports that the artisans making lacquered articles at the Museum are willing to give Rs 1·25 per pound for the improved lac introduced by the Society.

COCONUTS.

WHITE ANTS ON COCONUTS.

To the Editor of the Tropical Agriculturist.

Dear Sir,

In reply to your correspondent, Mr. Krishnaswami Row, regarding the ravages caused by white ants in a young Coconut plantation, I would suggest his trying the following mixture :

Crude Perchloride of Mercury.			1 lb.
Water	...	...	10 gallons.

The soil surrounding the young palms to be saturated with the solution

I think the above treatment will rid him of the pest, for some time at least. It works satisfactorily in the case of a rubber plantation.

Coconuts thrive best on a well-drained, rich soil. They require a good deal of moisture throughout the year, but the soil should be open, and the gradient of the land not too steep, in fact, a very gentle fall would be best.

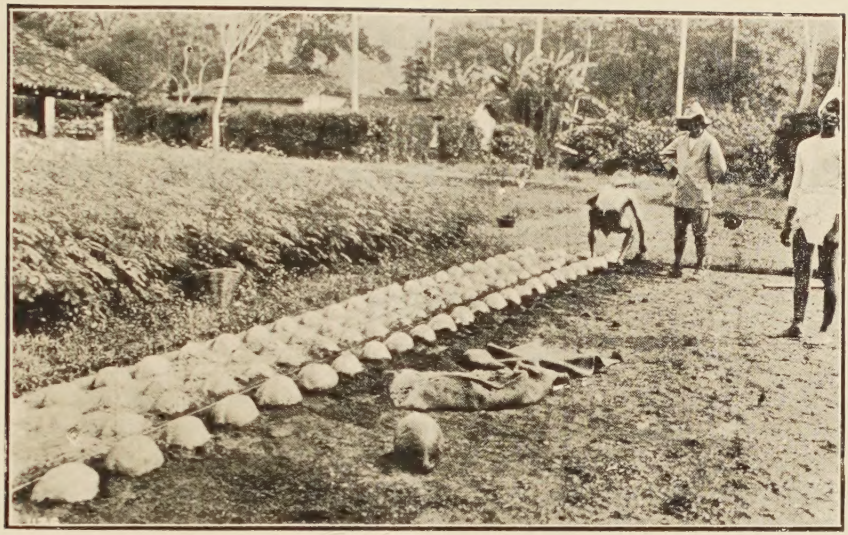
It has been found, as a general rule, that the best situation for a Coconut plantation is near the sea or along the banks of a river. It is widely believed that a situation not far from the sea is the best.

Yours faithfully,
C. J. CHADWICK,
General Manager,
The Burma Para Rubber Co., Ltd.

King Island, Mergui, L. Burma.
The 8th January 1914.

COCONUT BUTTER.

According to the United States Consul at Carlsbad (Austria), most of the Coconut butter manufactured in Bohemia is made of Cochin-China or Indian copra, which is received in large wooden tuns. The dried copra is sliced, and the fat is extracted by oil presses, quite a simple process. This raw oil contains soap fats and does not have a pleasant odour. It is placed in large tanks and the first step in the refining process is the addition of powdered chalk, which absorbs the soap fats and settles to the bottom of the tank. The oil on the surface is pumped into another tank, passing through four or five filters as the second step in the refining process. It is then forced into a tank heated by steam pipes to about 270 518° F. This process continues until the oil is as clear as crystal and begins to bubble. It is then pumped into an automatic weighing apparatus and run into the moulds, where it is allowed to cool. The tablets or cubes are removed to the packing table. Part of the



PLOTS SHOWING COCONUT NURSERY AND A PLOT OF LEUCAENA GLAUCA.

Leucaena Glauca is proving an admirable green manure standing cutting well and yielding many tons of green material per acre per annum. The plant is largely grown in Java and is to be found in several districts in the Low-country in Ceylon

It can be employed as a green manure or a light shade tree, from which seed can be obtained in quantity.

oil is run into various sized tubes and is also placed on the market in the form. The soap fats, combined with the chalk, are treated with sulphuric acid, which dissolves the chalk, leaving the fats floating on the surface of the solution. These are drawn off into tubes and are sold to manufacturers of soap. The trimmings of the copra slices are made into a powder, which commands a good price as fodder for cattle and pigs. The coconut fat is white, but when manufactured into butter is coloured to resemble oleomargarine. Sesame oil is added to make the product more pliant. Coco butter keeps well either raw or refined and does not spoil for months, even in warm weather. It is claimed that the ordinary consumer cannot detect the difference between this butter and oleomargarine. Six or seven years ago the output of coconut butter in Austria was about 40 tons a day. It is now approximately 300 tons. The price has increased from $18·25 to $26·40 for 200 pounds. The factories claim they cannot keep up with the demand. The market is controlled practically by two firms, one in Vienna and the other in Aussig.—WEALTH OF INDIA.

KAINIT AS A PREVENTIVE AGAINST WHITE ANTS.

According to MR. W. W. FROGGATT Entomologist a few pounds of kainit dug in about the roots of fruit trees will drive away white ants.—NEW SOUTH WALES JOURNAL.

PADDY.

CULTIVATION IN CEYLON DURING THE XIXTH CENTURY.

E. ELLIOTT.

(*Continued from p. 467, Vol. XLI.*)

IRRIGATION.

13. The total outlay (inclusive of the expenditure in SIR H. WARD'S time) on works in actual operation and benefiting cultivation at the end of 1906 (and their maintenance) amounted to nearly 9 million of rupees (8,888,546) or say Rs. 30 per acre benefited. But only *one-third* of this amount was expended on what were considered as *reproductive works*, nearly all in the Batticaloa and Matara districts. Both of which have repaid directly the entire outlay.

The balance has been expended on what would in India be termed "famine relief works as a struggle against nature and which seek to fortify the people against drought."

14. Against this outlay, a sum of about 4 million rupees has been recouped to the State by repayments on account of costs of construction and maintenance, rates (in perpetuity), sales of waste land (*otherwise unsaleable*) and the increased value of the Government tythe of the crops prior to 1892.

15. The construction of the irrigation works in question not only arrested the decay and depopulation previously prevailing in several districts, more especially in the North-Central and North-Western Provinces but stimulated an abnormal increase in the population, and consequently adding to the number of taxpayers contributing directly to the revenue. This may at a modest figure be estimated to have amounted by 1906 to 90,000 persons, each paying Rs. 2, making a sum of Rs. 180,000 per annum which by 1911 had increased to 125,000 persons and Rs. 250,000 in money, equivalent to 5 per cent. on the outstanding balance on account of the earlier works.

16. Under the new departure initiated by SIR WEST RIDGEWAY "prompted by a period of financial prosperity unparalleled in the history of the Colony," there has been a further expenditure on a series of large works, mostly in the backward districts, amounting by 30th June, 1911, to Rs. 8,546,654.

17. Of this sum of $8\frac{1}{2}$ millions, nearly $2\frac{3}{4}$ or 32 per cent. of the total expenditure is on "Establishment" as against $2\frac{1}{2}$ per cent. in 1889-92. Though some reduction may be made on the completion of the big schemes undertaken of recent years, a considerable staff will be required to attend to the upkeep of the works and to regulate the distribution of the water, as the magnitude of the areas now served renders it impossible for this to be regulated by the Government Agents as formerly.

18. The entire outlay on Irrigation from 1858 to 30th June, 1911, and the amount of the recoupments have been as follows :—

Expenditure :			Rs.
On the older works to end of 1906		...	8,888,546
On the maintenance thereof to 30-6-11		...	400,000
On new works including Establishment		...	8,546,654
	Grand Total	...	Rs. 17,835,200

Recoupments :	Rs.		
To end of 1906 ...	3,985,080	...	—
Further to 30-6-11 ...	716,033	...	4,701,113

Net expenditure to 30-6-11 Rs. 13,134,087

19. As against this outlay there is a "nest egg" formed by the payment of the cultivators for the 90 years previous to the abolition of the "Grain Tax" in 1892, and amounting to 50 millions of rupees.

20. In view of the slow rate at which paddy land is developed in Ceylon and the sparse population of all localities in which all the new works are situated, it would possibly have been wiser to have spread the large outlay since 1900 over a longer period ; but there is every reason to believe this will eventually prove—*given time*—as remunerative as the older schemes have been, provided the *same policy of consideration* and *easy terms are continued.*

21. The cardinal points in the past have been cheap land and cheap water. Chief amongst these was SIR HENRY WARD'S sanction of payment for land purchased from the Crown, in four annual instalments; (1) and the policy of permitting especially in Batticaloa, of the cultivation of Crown land prior to survey and sale. Next came SIR W. GREGORY'S alternative, allowing payment of Re. 1 per acre in perpetuity.

22. In view of the abolition in 1892 of the Grain Tax, the raising of the rate in perpetuity on new works to Rs. 2 per acre was perfectly justifiable, but the subsequent removal in the Ordinance of 1906, of any limit, and the proposals since made to require Rs. 3 and Rs. 4 per acre, are to be strongly deprecated, so *long as an additional charge is made for the land.*

23. It has been sought to justify this increase on the grounds that the tenth of the crop formerly taken by Government amounted from Rs. 3 to Rs. 6 per acre. This is erroneous as the average rate of the Grain Tax throughout the Island was only Rs. 1½ and in Batticaloa only Re. 1 per acre.

24. Another ground advanced in support of this increased charge, viz., that in India much higher charges are imposed, is also apparently made in ignorance that these are inclusive of a large proportion (in some cases as much as 9/10ths of the Crown rent of the buildings. According to SIR CHARLES ELLIOTT'S recent report "the actual loss to the State over irrigation in India is 73 lakhs of rupees per annum."

25. Under the Karachchi and other projects suitable settlers should be granted permission to *aswedumise* moderate extents of Crown land, expressed in sowing extent (previous to survey) free for the first year, but paying

Re. 1 per acre at the end of the 2nd year ;
Rs. 2 per acre at the end of the 3rd year ; and
Rs. 3 per acre in perpetuity ever after.

At the end of the six years when the payments will have amounted to Rs. 12 per acre a lease in perpetuity should be issued subject to an annual water rate of Rs. 3 per acre, based on actual survey. Private land already *aswedumised* should be liable to Re. 1 for first year and Rs. 2 in perpetuity afterwards.

26. Under such a scheme there would be after allowing for maintenance a return in the 3rd year of 5 per cent., on an expenditure of Rs. 50 per acre

27. The paddy grower in Ceylon is by no means an ignorant agriculturist but follows methods which practical experience of centuries has proved to *pay him best*. Thus, if the great improvements suggested by European critics, ploughing and transplanting, are not practised in any district, there are good grounds for the alternative methods followed. Figures have been given to show that in Batticaloa where neither practice is adopted, the average production of paddy is seven bushels per head of the population against half this in Kandy district where both prevail.

28. Though the provisions of cheap land and cheap water are the chief considerations necessary to extend paddy cultivation there are other methods of aiding it. For instance, by the introduction of improved seed, especially in Batticaloa. This should be done by growing suitable foreign seed, which is necessarily procured in small quantities, at Government farms and so increase the quantity for distribution.

29. More funds should be allowed for the opening of roads in the rice-growing districts or the District Road Committees should be allowed for the purpose the two-thirds of the funds they collect now contributed for the upkeep of the principal roads, which should in view of the present financial prosperity be entirely met from the general revenue.

30. Steps should be taken to reduce the number of wild elephants which the Director of Irrigation recently reported as doing "serious damage to works and channels" and which, for some years past, have become numerous and bold and were a source of danger and loss to cultivators in the jungle district even before I left the Island in 1902.

31. The railway charge for the carrying of paddy (for the reason already stated) should be reduced to sixth class rates; 8 cents per ton per mile especially in the Northern line, instead of 12½ cents., the present charge.

PLANTING IN GUATEMALA.

A correspondent with plantations in Guatemala has sent us an interesting letter describing some of the products in that country. Coffee is the chief export being from 700,000 to 900,000 cwt. Referring to the article on the proposed scheme for a College of Tropical Agriculture in the August number of this Journal, he says: "Kindly let me know when anything definite is arranged as I would probably send one of my sons out there."

TOBACCO.

RAINFALL AND TOBACCO.

G. SCHAEFFER.

The best quality of tobacco leaves are produced when the plant grows very rapidly; consequently an abundant and readily available water supply at the right moment is an important factor in the production of high class tobacco. Dry weather in the early stages of plant growth would cause a considerable development of the root system in search of moisture; should this be followed by rains (about a month after planting out) optimum conditions should then obtain for rapid growth. Such favourable conditions prevailed during 1911 at Deli, Sumatra, whilst in 1909 the weather conditions were quite the reverse. The quantity of tobacco harvested at Deli in 1911 was slightly greater than that harvested during 1909, but its quality was considerably better, as shown in the following table :—

Years.	Rainfall in inches.		Price per lb.
	March	April.	
1909 ...	5·3	1·8	1*s.* 3*d.*
1911 ...	0·2	9·1	2*s.* 2*d.*

—Monthly Bulletin.

THE ENZYMES OF THE TOBACCO PLANT.

J. Du P. OOSTHUIZEN AND O. M. SHEDD.

Many chemical changes take place in the tobacco plant throughout its growth as well as during the curing and fermentation periods. New chemical substances are formed and others are decomposed. The final result of these reactions gives the colour, texture and aroma to the finished product. A change in these transformations is sufficient to destroy the value of the crop. Several authorities have attributed the curing process to bacterial agencies. If this were so, it would be possible to produce any desired brand of tobacco simply by inoculation. Recently, however, Lœw has shown that these changes are not caused by bacteria, but are due to soluble ferments or enzymes, which are produced in the plant during its development; he has shown the presence of diastase, oxidases, peroxidases, proteolytic enzymes and cellulose-dissolving enzymes. According to him, the fermentative changes in the tobacco leaf are caused by two oxydising enzymes which take oxygen from the air and effect the decomposition of the various components of the leaves

with the formation of new products. These enzymes are in the nature of proteins, and are present in the protoplasm of the cells. Under favourable conditions they are set free in the leaf tissues and effect the above-mentioned changes. They are easily destroyed by excessive heat or too rapid drying.

The writer has studied these enzymes in two typical tobaccos in Kentucky, viz., the White Burley variety and the dark type Yellow Prior. He made experiments with the seeds, green leaves in different stages of development, cured leaves, and with a sample of soil. The seed and leaves showed in every case the presence of appreciable quantities of invertase, diastase, emulsin and reductase, in many cases inulase and a proteolytic enzyme were also found. Soil, on the other hand, contained no enzymes except in two cases. Oxidases appears to be present in the tobacco leaf at all stages of its growth and gradually increase in amount from the seedling stage until the topping stage, after which they gradually decrease until, in the cured leaf, they practically disappear.

During the curing and fermentation periods there is a great loss in weight, as much as 15 per cent., about $\frac{1}{4}$ of which is solid matter. Certain gases are developed, amongst which ammonia is easily detected. Practically all the starch disappears during the early part of the process and sugar is formed as a new product. This shows the important part played by diastase. The sugars also disappear, being probably destroyed by oxidases. The presence of invertase leads to the conclusion that cane sugar may be stored in the root and afterwards translocated to the leaves. The protein content of the leaves decreases considerably during the ripening of the plant, also during the curing and fermentation period. The presence of amino-compounds during these processes is further proof of proteolytic enzymes. The nitrates also decrease and the nicotine content diminishes. This suggests the presence of reductase and probably there are enzymes acting on the resins and gums. It is believed that the aroma of tobacco is partly due to the decomposition products of gums and resins, as well as to the breaking up of glucosides. Positive tests have been obtained for a glucoside splitting ferment. The presence of fats and proteins results in tobacco of inferior flavour. They are removed by lipeolytic and proteolytic enzymes, provided the conditions are favourable.

The characteristic brown colour which develops during fermentation is attributed to the action of oxidases. During the smoking process it has been shown that an ethereal oil is formed from certain products and this probably contributes to the flavour. Critis, malic and oxalic acids are found in greater quantities in the cured leaf than in the green leaf. These are probably transformed to acetic and butyric acids during fermentation. Thus we see that numerous complex chemical changes take place during the growth, curing and fermentation of tobacco and that enzymes play a very important part in these changes. For the product to obtain the greatest commercial value, extreme care and attention is necessary at the critical stage of maturity and also during the curing and fermentation.—Monthly Bulletin.

FIBRES.

JUTE IN LOWER BURMA.

A. M. S.

To the world in general, the rapid strides made with the cultivation of Jute in Bengal and the marvellous developments that have supervened in the industries dependent upon its fibre as their raw material point a lesson of considerable significance; for, they combine to illustrate, and that most strikingly, the immense possibilities of a product which, though of little merit in itself as such, may, nevertheless, by pandering to some of our daily needs, become a commodity of inestimable worth from its capacity to adapt itself to them. Vast sums of money are invested in the production and manufacture of Jute and its fabrics as well as in the trade in these great products. At least two centres of textile manufacture—Calcutta in the East and Dundee in the West—depend upon Jute as the life of their activities and for much of the industry which is helping to build up immense fortunes in them both. And yet, jute is the weakest of all the vegetable bast fibres produced in the Eastern Tropics. From its inability to withstand the effects of moisture once it has been dried and spun or woven, the fibre of Jute is unsuited for the fabrication of materials liable to exposure to the weather. It deteriorates readily in all damp climates, even in situations in which it is seldom directly open to the action of the weather. No devices that have yet been invented or discovered serve to lend it the strength it lacks. Hence has it come about that the chief application of the fibre of jute in the world at the present time is confined to the fabrication of, though a host, yet but a host of perishable goods. Among this array of the fabrics from jute mention may be made of the "mercerised" stuffs that go to swell the list of "silk substitutes," the coloured shirtings that resemble linen goods, curtains, carpets, gunnies and gunny cloth, and the coarser kinds of canvas and sail cloth. Paper and cordage of sorts are also largely prepared from jute and jute-waste, but the most universal and therefore valuable application to which jute fibre is put is in the weaving of cloth for gunny bags. Few materials even though stronger have been found to equal, much less rival, jute for the purpose of producing a fabric that, from its lightness, suppleness, and comfort in handling, is adapted for the transport and storage of commodities which can all be carried and stacked in sacks. Jute is an ideal sacking-material and, despite the prevalence of a host of fibres that seem to menace its unique position in trade, is likely to continue to maintain that position, possibly, for many long years to come. There is always a lively demand for Jute from the constant absence of a sufficiency of it to meet the growing needs of the world. Paradoxical though the statement may seem, it is, nevertheless, true that the "weakness" of jute is itself the primary cause of its "strength," for the rapid deterioration of the fibre necessitates an almost incessant supply of it to minister to the exigencies of the trades that use it. Thus, in whatever country jute is produced, a market for it, either local or foreign, is likely to be more than assured the product. But what are

the conditions, natural and economic, that are requisite for the successful production of jute? The interesting facts which are summarised below may help to return an answer to this question :—

Though jute can be grown on many kinds of soil—some people even say that *any* soil will suit it—it is usually most productive on loamy soils that are deep and rich in organic matter. The finest qualities of jute are produced on soils that grow the various peas and beans, cold-weather rice, tobacco and such other crops—all which, therefore, admit of being raised with success when grown in rotation with it. Sandy soils produce a coarse fibre and though clayey ones give the heaviest returns, the jutes that are grown on the majority of such soils do not, as a rule, ret uniformly. Of all the soils on which it can be raised, those least suited for it are laterite, open gravel and free sands. The manuring of jute lands is essential even for the richer soils of the tropics where the drenching showers of the monsoon rains, though washing in nitrogen from the air, wash out nitrogen from the earth-particles. The most suitable fertiliser for jute is cattle dung, but, in its absence, green manures would result in the production of a congenial pabulum. Jute is grown in low-lying situations and such as are subject to periodic floods. Locations on which the receding waters of rivers swollen with annual floods, leave deposit of silt on the surface are especially suited for jute-cultivation. Swamps and marshes, if thoroughly drained, are also admirably adapted for jute; but with deficient drainage these are subject to the menace of water accumulating in the soil during seasons of occasional heavy rainfall and the consequent formation in the crop of roots high up on the bases of the stems. Such roots detract much from the value of the crop, when cut, for length of fibre and are discouraged only by careful drainage. As regards climate, jute can be grown successfully only in hot damp ones—the best results with it being obtained under those moist climates within the tropics that do not develop too much rain during the early period of the monsoons. Jute can be grown in drier climates if raised in the cold weather under irrigation; but, having regard to the general cheapness of the fibre, the matter of the expense of irrigating jute has to be weighed with considerable care. Many forms of jute are wild in Burma—chiefly on rice fields, other wet-land, and the low-lying vicinity of *Ins* or fresh water lakes and the low flat banks of sluggish streams. They do not affect saline salts nor saline situations near the sea. The species which is the most frequently met with is the *Corchorus olitorius* (*Pilo-yin and Pilo-yine*). The others especially in Upper Burma, are *Corchorus fascicularis* and *Corchorus trilocularis* (both locally known as Pilo-kha). The *Corchorus capsularis* too, is found, but sparingly, on the margins of *Ins*. Of these species, the cultivated jutes are derived from *Corchorus capsularis* and *Corchorus olitorius*—the indigenous conditions of occurrence of which would indicate that the localities of their prevalence, at any rate, are suited for their economic cultivation. According to the earliness or lateness of the season in which the flowers of the varieties bloom, the cultivated forms that are grouped under them are also separable into early and late ones. It is of much importance, in more ways than one, to know in which of these flowering classes a particular jute, to be grown, is placeable; for only the late-flowering forms produce fibres of the finer and stronger grades. Jute is a

very susceptible species and shows considerable powers of adaptivity to the factors prevalent in the locality of its cultivation; and whatever be the original features of a jute, they alter to meet the needs of the situation. Thus unless the desirable features of a strain are sustained or perpetuated through selection ("artificial" choice), the tendency in Nature being towards deterioration, undesirable characters interfering with its market-value are liable in time to evolve in the crop. Selection, then, is an essential condition for success in the regular cultivation of jute. The other factors whose combined and continuous presence is requisite for jute production are clean and thorough cultivation, streams of fresh and flowing water, true perseverance and cheap labour. The two latter, but especially the last condition, are perhaps the most important which demand satisfaction of the farmer and the situation he selects.—BURMA ECONOMIST.

SISAL HEMP IN FIJI.

(*Continued from p. 481, Vol. XLI.*)

The leaves start out in a vertical position in the centre of the plant and, with the development of younger ones, they gradually incline until they become horizontal. If still left on the plant they die, and may be found on an old uncut plant lying on the ground in the form of a fibrous mass attached to the stem.

It is generally understood that leaves are mature when they have reached an angle of 45 degrees to the vertical.

It will be noticed in plants that have not been cut that the lower leaves are quite short and the upper ones longer and longer up to the central ones, which may be $4\frac{1}{2}$ or 5 feet long.

The leaves do most of their growing in the young state and in the centre of the plant; when they are mature they do not lengthen. Fibre for rope-making should be at least 3 feet long, and the plants are ready for cutting when mature leaves of this length are to be obtained. The first cutting will include all the small leaves, which will be useless for fibre purposes, but should be cut off to enable the rest to be removed the more easily.

The exact age for cutting will depend on the rate of growth. At the experiment stations the first cutting was made in from 3 to $3\frac{1}{2}$ years after planting, which is likely to be an average time.

There appears to be no harm in leaving the leaves on the plant for some months after they are ready to cut, and the cutting may therefore either be arranged so as to remove a few leaves several times or more leaves fewer times a year as found most convenient. There is no particular season for cutting leaves, they are maturing at all times during the year and may be cut during any month.

The milling of the leaves will, it is presumed, be carried out during the dry months, April-October, and the cutting will be arranged to extend over this period so as to keep the mill regularly supplied. All the leaves that mature during the year should be milled, and if 30 leaves are matured per plant per annum, it is recommended that two cuttings of 15 leaves each or three of ten leaves be made rather than one of 30.

The leaf is removed by a clean cut as close to the stem as possible, for the butt end has most fibre, and if part of the leaf is left on the stem there is some considerable loss. A hooked knife is most convenient and it should be sharp.

The leaves are now ready to be carried to the carts or trucks, either loose or in bundles as may be found convenient.

POLING

It has been remarked that sisal hemp plants (like all agave) end their leaves by "poling."

The "crop period" of a plant will be from the first production of leaves fit to mill (3 feet long) up to the time of poling. The question as to how long this crop period will be is of great importance to the sisal-hemp industry.

If left to themselves and no leaves were cut from the plants they would in the course of some years, send up poles, and the average time may be looked upon as the natural period of the plant's existence. With the regular cutting of mature leaves, however, it is understood that the time of poling may be delayed for some years.

The question of early poling of sisal hemp was gone into very thoroughly in connection with the industry in the Bahamas in 1893, and a full account is given in the paper already referred to (Colonial Reports, Miscellaneous Series, No. 5,1896) by SIR DANIEL MORRIS. Whether neglecting to cut the mature leaves induces early poling or not, it is clear that cutting immature leaves certainly does so. The plant is weakened by this process, the leaves subsequently borne are smaller and fewer and its life is ended sooner; another point mentioned in this account is that when root-suckers are allowed to remain attached to the parent plant, it is believed that they exhaust the parent plant and accelerate the period of poling.

The nature of the plants used for planting has some effect on the time of poling, as has already been mentioned, and it may perhaps be repeated that using pole-plants taken from old plants cut for fibre production may give rise to early poling, and further that the use of suckers from plants that have poled may give rise to the same result.

To summarise briefly, it seems that early poling, a very undesirable feature in plants used for the production of sisal-hemp, may be induced by :—

1. Cutting immature leaves.
2. Allowing root-suckers to remain attached to the parent plant.
3. Propagating by means of "pole-plants" from old plants that have been regularly cut.
4. Propagating by means of suckers from plants which have poled.

In this industry, as in all other agricultural undertakings, a great improvement can be brought about by careful selection of the plants for propagating purposes. The matter of early poling is one that should be borne in mind by all sisal-hemp planters. It will certainly happen that some plants will pole before others, and if any are observed to pole phenomenally early, it would be as well to disregard them as a source of young plants, otherwise a strain of early-poling plants may be established.

In an article on "The Principal Commercial Plant Fibres," which appeared in the YEAR-BOOK OF THE UNITED STATES DEPARTMENT OF AGRICULTURE, 1903, the average length of the cutting period in Yucatan is said to be 12 to 20 years, 10 to 15 years in Cuba, and 6 to 12 years in the Bahamas.

On the appearance of the pole it may be cut off, or bent over, which will enable leaves to be obtained for a further period of about a year.

We have no data to go on in regard to the length of time of this crop period in Fiji, and it is a matter which will be carefully watched, and especially in regard to the differences that may be shown by plants grown in the wet and dry zones respectively.

It is unlikely that all the plants in a cultivation will pole simultaneously, and even when poles do appear there is still another year of cropping. The cutting of leaves on a plantation can be made almost continuous by planting suckers in the spaces between the plants when poles commence to appear, and by the time all the old plants have poled and are removed the ground will be occupied by the new plants nearly ready for cutting.

The details of this replanting will possibly be best worked out for each individual case when the time arrives.

EXTRACTING THE FIBRE.

In connection with each plantation of sufficient area, a mill will be required, equipped with suitable machinery for cleaning the fibre and for baling it after it is dried. Wires will be required on which the freshly-prepared fibre may be hung out to dry and bleach. A good supply of clean water is necessary for washing the fibre during the process of milling.

YIELD.

In Yucatan the usual return is said to be about 1,200 lb. per acre of 650 plants. It must be remembered that in that country most of the fibre is obtained by the use of primitive and rather wasteful machines. This may be taken as an average yield over large areas and may certainly be used as a basis for calculations.—FIJI PLANTERS' JOURNAL.

FLAX CULTURE IN BRITISH EAST AFRICA.

W. DALLIMORE.

During the last few years experiments in flax culture have been conducted at several Agricultural Experimental Stations and Mission Centres in British East Africa, more for the sake of the seed than the fibre, however. In the event of flax proving a suitable crop for the country it is more than likely that the fibre will be given consideration likewise. The following extracts taken from the "ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, BRITISH EAST AFRICA," for 1911-1912, give an idea of the position up to date. On page 77, MR. H. POWELL, General Manager of the Kabete Experimental Farm, writes:—"Four acres of linseed, Riga variety, were sown on 1st. May 1911, and harvested on 12th September. It yielded 588 lb. per acre. This crop continues to do well here. Ten acres were sown on the 21st November and cut on the 22nd March 1912; the yield was 319 lb. per acre. About the middle of January the crop was completely eaten off by caterpillars but the heavy rains in February enabled the crop, which at one time was on the point of being ploughed up, to recover. The prevalent wet weather during April retarded threshing and the yield was really in excess of the figure given."

Regarding its culture at the Government Experimental Farm, Kibos, MR. H. H. HOLDER, Plant Instructor, wrote on June 25th 1912 (see p. 100 K.B.) :—

"Linseed.—The success which attended the trials made by the REV. FATHER WITLOX, of the Roman Catholic Mission at Kakamega, two years ago, and also those by certain headmen and natives there, led to a series of experiments being started at Kibos with two varieties, introduced by the Chief of the Economic Plant Division from Ceylon, and two Russian varieties from the Kabete Experimental Farm, Nairobi. The Ceylon varieties which consist of one brown and one white are lower growing in habit and produce a considerably larger sized seed than that of the Russian varieties. The trials were conducted with a view to testing their bearing qualities. Accordingly four plots were laid down on the same ground as follows:—

"Two plots, two acres each in size, were sown broadcast with the Russian varieties, and two plots, one acre each, sown in drills with the Ceylon varieties.

"All the varieties made fairly good growth at first, but the Ceylon varieties appeared to have withstood the dry spell in June much better.

"Although the climatic conditions at Kibos are not considered to be altogether ideal for linseed cultivation, it might be premature to ascribe the cause for the poor results obtained with this first trial to this alone, as planting was carried out rather late in the season. Indeed, judging by the rapid spurt of the Ceylon varieties made after every shower of rain which occurred when the plants were in the field it appears safe to believe that, planted at the commencement of the rains in March or April on a well-drained and thoroughly prepared soil, the crop may be cultivated with equal success here as at Kakamega.

"Besides the native trials at Kakamega, a plot was planted at Sagam which did equally well under Headman Obonyo.

"Perhaps none of the other introduced crops have taken on so rapidly amongst the natives and there seems every prospect of its cultivation becoming in a short time thoroughly established throughout a large portion of the Nyanza Province."—KEW BULLETIN.

ELECTRICITY IN THE SERVICE OF HORTICULTURE.

The possibility of employing electricity in horticulture and agriculture has long occupied the minds and engaged the attention of men of science, and although the realisation of this possibility is long in coming there are indications that it will soon be achieved. LEMSTROM long ago claimed to have demonstrated that an increase of some 45 per cent. in a crop is produced by the agency of high-tension electricity applied to the land by means of overhead wires, as is pointed out by MR. THORNE BAKER in a paper read recently before the Royal Society of Arts. SIR OLIVER LODGE, MR. NEWMAN, and PROFESSOR PRIESTLEY, working with overhead discharges, have also obtained encouraging results. The cost of installation of the Lodge-Newman apparatus works out at £200 for 25 to 30 acres, and for the treatment of double that area only a small increase in cost is entailed. It is interesting to observe that the Departments of Agriculture of the United States and Egypt have provided themselves with the LODGE-NEWMAN apparatus.—THE GARDENERS' CHRONICLE.

SOILS AND MANURES.

MANURES AND SOIL FERTILITY.

F. B. GUTHRIE.

The trend of recent research in agricultural science has brought forcibly home to us the fact that the function of fertilisers is not restricted to the duty of supplying plant-food to the growing crop. Under certain circumstances, indeed, this function is in abeyance—in the absence of sufficient water, for example, or in the presence of unfavourable soil-conditions, the action of fertilisers is almost negligible—and it is our lack of understanding of these conditions that has been the frequent cause of want of success in the use of manures.

The idea that failure in plant-production is due solely, or even chiefly, to deficient plant-food in the soil is no longer tenable.

Recent investigations have brought to light a host of other causes of infertility, but the idea still persists at the back of many soil analyses that the determination of the amount of certain specified plant-foods, dissolved by specific solvents from the soil, is a certain guide to the nature of the manuring required. As a matter of fact, neither the chemical composition of the soil nor of the crop affords any certain foundation on which advice as to manuring can be based.

A. D. Hall and E. J. Russell,* dealing with the results of a soil survey of the south-eastern counties of England, draw, amongst other general conclusions, the following which have special reference to the connection between the composition of the soil and plant: "We are not as yet in a position to deduce the agricultural properties of a soil, either its behaviour under cultivation or its adaptability to particular crops, except in the roughest general fashion."

In dealing with a number of typical wheat-soils the authors say "Chemical analysis of these soils revealed no connection between their chemical composition and their suitability for wheats," and the same remark applies no doubt to other crops. They also point out that excess or deficiency of any particular plant food, such as nitrogen, does not necessarily imply a fertile or infertile soil.

Even in the case of calcium carbonate they show that many soils poorly supplied with this ingredient are not benefited by the application of lime, whereas for other soils examined, containing the same or a greater proportion, liming is essential.

They find that, "other things being equal, dry soils are more likely to respond to potassic manuring than others better supplied with water, but no richer in available potash."

* *Journal of Agricultural Science*, Vol. 4, p. 182.

The same applies to phosphoric acid. "Little, if any, direct connection can be traced between the phosphoric acid and the productiveness."

As far as regards the value of soil-analysis, as a basis on which to afford advice as to soil treatment, I have no reason to alter the opinion expressed in a paper on "Soil Analysis," read before this Association at the Brisbane meeting, 1895, wherein the view is expressed that a rational scheme of soil-analysis which shall attempt rather to determine the factors influencing fertility than to elaborate methods for determining the chemical constitution of the soil, can be made of considerable value to the farmer. This statement has been amply borne out by experience, and to-day the analysis of farmers' soils on the lines then laid down is one of the functions of the Department most regularly availed of by farmers.

Spite of all the labour expended for many years on this subject, manuring still remains very largely empirical in its nature. We know, in a broad and general way, that a soil deficient in plant food is not likely to produce good crops without manuring, and that a soil rich in plant food is likely to prove a fertile one. But much further than this we cannot go. If a soil is well supplied with, say, nitrogen and potash, but poor in phosphates, it by no means follows with any certainty that it will be benefited by phosphatic manuring.

We know further that certain fertilisers benefit certain crops. We know, for example, that the application of superphosphate will probably increase the yield of wheat and other cereals; but this knowledge is not derived from information supplied by the composition either of the soil or the wheat plant.

The wheat crop, grain and straw, contains only half the quantity of phosphoric acid that it does of nitrogen, and much less than it does of potash and yet we know that neither nitrogenous nor potash manures are anything, like as effective as soluble phosphates in increasing the yield. Nor does soil analysis help us to any extent. The soil may be comparativly rich in phosphates and poor in nitrogen and potash, and still phosphatic manuring is the more effective. Our wheat soils in the semi-dry country are indeed lacking for the most part in humus and nitrogen, and yet it is by the application of superphosphates and not of nitrogenous manures that crops are successfully grown.

The case of leguminous plants is of a similar nature; crops like peas and beans and clover contain more nitrogen than other fertilising ingredients, and yet manuring with nitrogen is resultless, and the ingredients which are most beneficial are potash and phosphates. Here again, it is immaterial whether the soil is rich or poor in nitrogen or rich in potash. The composition of fruit trees does not explain why potash manuring should be of such special benefit, nor is there any satisfactory explanation why the mangel crop—which contains nearly four times as much potash as the potato crop—should not benefit by the application of this ingredient, whereas it is an essential, a "dominant" ingredient for manures applied to potatoes.

TOXIC SUBSTANCES IN SOILS.

That substances are formed in the soil, either as the result of the decomposition (chemically, or by means of micro-organisms) of crop-residues, or excreted by the growing plant, seems to be abundantly proved. *

* Schreiner and Shorey Bull. 74, Bureau of Soils, U. S. A.

O. SCHREINER was the first to show the tosi effect of dihydroxystearic acid and to isolate this substance from soils on which wheat failed to grow. ‡

Further experiments by the United States Bureau of soils § have shown that quite a large number of organic substances exercise a toxic action on plant growth.

F. FLETCHER ‖ describes experiments showing the extraordinary influence of the neighbourhood of sorghum and of maize upon the growth of "sesamum indicum." This is not due to the removal of moisture or of plant food by the maize crop, as both these essentials were abundantly supplied to the sesamum, but must, he concludes, be attributed to the excretion of a toxin by the roots of the maize plants. FLETCHER believes this to be a salt of dihydroxystearic acid.

Among the numerous toxic organic compounds which SCHREINER and his fellow workers have found to be present in the soil, three or four have been more particularly studied in relation to their action upon plants provided with varying quantities of the recognised fertilising ingredients.

SCHREINER AND SKINNER ¶ have shown that in water culture with wheat, dihydroxystearic acid is least harmful when the plant is provided with fertilising substances relatively rich in nitrogen (such as nitrates), and that in the presence of this soil toxin the plant removed less phosphoric acid and potash than under normal conditions, but that its absorption of nitrogen was more nearly normal.

The action of other soil toxins was made the subject of further study † and the following very interesting and rather remarkable results were obtained:— Vanillin (all aldehyde) behaves in very much the same way as dihydroxystearic acid in its general effect upon roots and leaves, and its effects are least when the plant is supplied with nitrates. It is pointed out that nitrates increase root-oxidation, wheaeas both dihydroxystearic acid and vanillin, being capable of further oxidation, are themselves reducing agents.

Quinone is another organic substance whose presence affects the growth of plants. Unlike the two substances mentioned above, quinone is an oxidising agent, and its ill-effects are less marked when the plant is supplied with relatively large proportions of sulphate of potash, which has a known influence in restraining root oxidation.

A fourth substance is coumarin, a substance of fairly wide distribution in the vegetable kingdom, and found to be toxic to many plants. SCHREINER AND SKINNER †† find that it is particularly toxic to wheat, the leaves being short and broad, and the roots discoloured, and their surface very shiny. The harmful effect of this substance was greatest when phosphoric acid was absent from the nutrient solution, and practically disappeared when the fertiliser was rich in phosphates. The same results were obtained with wheat plants grown in soil in culture pots.

‡ Bull. 53, Bureau of Soils, U. S. A.
§ Schreiner and Reed, Bull. 47., Bureau of Soils, U. S. A.
‖ *Journal Agricultural Science.*
¶ Bull. 70, U. S. A. Bureau of Soils.
† Schreiner and Skinner, Bull. 77, U. S. A. Bureau of Soils.
†† Loc.cit.

It would, therefore, appear that the bad effects due to the presence of dihydroxystearic acid and of vanillin can be to a large extent neutralised by the application of sodium nitrate, those due to coumarin by phosphoric acid, and those due to quinone by sulphate of potash. With the exception of coumarin, these experiments were carried out apparently only in water culture experiments, and the point must not be lost sight of that these results when tried in the field may be considerably modified by the chemical or physical nature of the soil. They are sufficiently striking to emphasise the fact that the function of fertilisers is not solely to supply plant food.

FUNGI AFFECTING CROPS.

Another way in which one crop may affect injuriously a succeeding crop is by the production of a fungus which infects the soil and attacks the young plants. A fungus of this nature has been found by H. L. BOLLEY* to be the cause of what are known as flax-sick soils, that is soils which after continuous cropping with flax (which does not unduly exhaust the soil) are unable to produce flax. He quotes an experiment in which flax was grown for six consecutive years on a fertile soil of the Red River, the results being that the land was "in such a diseased condition that not a plant of flax can exist on it longer than three weeks from the time of sowing." This condition of things is well known in Europe and America to flaxgrowers, and it is the custom in Europe at all events to sow flax at intervals of not less than eight years on the same land, the flax being part of a rotation including turnips, oats, clover, wheat and beans.

BOLLEY has found that this flax-sickness is due to the growth of a fungus which he calls *Fusarium lini*, which lives in the humus of the soil and attacks the flax plant.

Manuring of any description was quite ineffective in improving the growth of flax or in destroying the fungus, nor did treatment of the soil with any of the usual fungicides produce any better results. There appears to be no way to rid the soil of the parasite, as the fungus lives in the soil for many years without any flax crop to feed upon. This fungus does not appear to attack any other crop.

The remedies suggested are treatment of the seed with substances such as formalin, and a five years' rotation of flax with wheat, hay, pasture, and maize.

BOLLEY has also shown that the deterioration of wheat-lands is brought about by three or four parasitic fungi (in a latter communication he gives the number as at least five), whose growth is encouraged by the practice of continuous cropping of the land with wheat, and which are propagated and attack the wheat in exactly the same way as flax is attacked by *Fusarium lini*.

Similar instances of loss of crop-producing power have been long familiar, that of clover sickness being one of the earliest to be recognised Peas, beans, turnips, and cauliflowers are all subject to parasitic fungi which grow on the buried portions of diseased plants and communicate the disease to healthy plants. The same is also true of many of the fungus diseases which affect the potato, tomato, etc.

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* *Bull. 50, North Dakota Agric. College, 1901.*

INFERTILITY OFTEN DUE TO BAD HUSBANDRY.

In all these cases we have toxic conditions which are quite distinct from the infertile condition brought about by soil-exhaustion, conditions which are not dependent upon the richness or poverty of the soil, and which no amount of manuring in the ordinary sense will remedy. Indeed, when we consider the large store of plant-food in average and even in poor soils, the comparatively small proportion removed by even the most exhausting crop, and the fact that this store of plant-food is being constantly rendered available, it becomes difficult to realise that a few years' cropping can effect such a complete removal of plant food, as we must assume to take place if the soil is exhausted in the manner usually recognised.

As a matter of fact, analyses of European soils go to show that under continuous cultivation there is little or no difference in the mineral content of the soil. In short, the inferior crop-producing power of a soil after repeated cropping is due to other and more obscure causes than the simple depletion of the soil in plant-food.

It is open to doubt whether such a thing exists as an infertile soil, that is, one which will not give satisfactory results under proper treatment. Plants, we know, can be grown in ignited sand or distilled water, if the proper nourishment is supplied. The barren regions of the earth are all capable of being made reproductive under proper treatment, witness the alkali-lands of Texas, and the salt-lands of Utah. Even the desert yields abundantly in the fortunate places where springs occur, or where the land can be inundated by rivers. On the other hand misapplied energy may convert a fruitful country into an unproductive one, and much of the desert and sterile land has once been fertile, and has been brought to its present condition by unthrifty husbandry.

PLANT SECRETIONS NOT ALWAYS TOXIC.

The secretions of plants are not, however, necessarily always toxic to other plants. The beneficial results of growing leguminous plants with non-legumes is well known, and an experiment carried out by J. G. LIPMAN shows this particularly well.*

LIPMAN grew oats in quartz-sand in porous pots which were placed on larger pots also filled with quartz-sand in which field-peas were grown. The sand in both cases was supplied with the necessary mineral fertilising constituents, but with no nitrogen. Both plants grew vigorously, the oats obtaining their supply of nitrogen by the diffusion of soluble nitrogenous material from the outer pot in which the legumes were growing.

If, instead of a porous inner pot, the oats were grown in glazed pots and were thus unaffected by the nitrates formed by the legumes, they produced a much diminished yield, and showed the growth and colour associated with lack of nitrogen.

Another case in which a beneficial action is exerted on the growth of plants by organic soil-constiutents, and one in which such action cannot be attributed to any direct fertilising power, is furnished by creatinine and

Journ. Agric. Science, vol. 3, p. 297

creatine. Creatinine is an organic substance which exists not only in the humus of soil, but in farmyard and organic manures, and in many plants and seeds, and whose presence in the soil has been found to indicate fertility.

The United States Soil-Bureau† have isolated and experimented with this substance, and with creatine, of which latter it is the anhydride. These authors have found it in stable manure and peas used as green manures ; also in wheat, seedling wheat grain, bran, rye, some leguminous plants, and potatoes.

Both creatine and creatinine are nitrogenous substances, and experiments in manuring show that they can replace nitrate in its effects on plant growth at all events in culture solutions.

MICRO-ORGANISMS-TOXIC AND BENEFICIAL.

In yet another direction a great deal of interesting work has been done, showing the part played by minute organisms in relation to soil fertility. It had been known for some time that treatment of the soil both by heat and by antiseptics favoured the growth of crops.

S. U. Pickering‡ found that when soils were either heated or treated with antiseptics the total soluble organic matter of the soil was increased, and at the same time toxic conditions were produced which hindered germination, such inhibitory action being, however, only temporary, as the toxin was subsequently destroyed, presumably by oxidation.

E. J. Russell and H. B. Hutchinson,†† in an elaborate and careful series of experiments, appear to have shown conclusively that the beneficial effect of partial sterilisation by heat or antiseptics upon the growth of the crop, is attributable to the larger proportion of ammonia present in the soil after such treatment. These authors explain this phenomenon as follows:—Probably in all soils certain larger unicellular organisms (protozoa) are present, which feed on the bacteria concerned in the formation of soluble nitrogen compounds and keep them in check. If the soil is partially sterilised by heating for a short time to the temperature of boiling water, or by subjecting it to the action of vapour such as chloroform, bisulphide of carbon, toluene, etc. (such vapour being subsequently removed by spreading the soil out in a thin layer and allowing the vapour to evaporate), the effect is to destroy the protozoa and probably most of the bacteria as well, but not the spores of the ammonia-producing bacteria. These spores subsequently develop, and in the absence of the hostile protozoa, their development proceeds with increased activity, the result being a considerable increase in the soluble nitrogenous plant-food and a more vigorous crop growth.—Science Bulletin, N. S. W.

† Schreiner, Shorey, Sullivan and Skinner, Bull. 83, Bureau of Soils. U. S. A.

‡ Journ. Agric. Science, Vol. 3, pp. 32 and 258.

†† Journ. Agric. Science, Vol. 3, p. 111.

FERTILITY OF SOILS.

We have for long been forming the opinion which we now feel definite about, that it is not lack of fertility that is wrong with any soil here that will not grow good crops. A really poor soil is rare in Jamaica. The fertility is not gone, but the humus often is. The negative results in the majority of the experiments in bananas, cane and cocoa—which are the crops which have been most systematically experimented upon—in the use of fertilizers have helped us in coming to this conclusion.

In Dominica the application of a mulch on cocoa proved more profitable than the use of fertilizers, and as that is a country of heavy rainfall, it was not because the mulch conserved moisture but because of the addition of so much humus. In Trinidad the experiments with fertilizers on cocoa have been mostly negative. Here the Department of Agriculture have had negative results with fertilizers on sugar-canes and bananas, generally speaking. Yet the application of fertilizers on a leguminous crop shows visibly good results in the increased growth of the peas or beans grown as green dressings, compared with non-fertilized crops—and through the fertilized green dressings the bananas and cane benefit from the addition of a greater amount of humus containing stores of nitrogen, potash, phosphoric acid and lime.

Lands that would not grow bananas at all, now, simply through a thorough system of trenching are growing magnificent fruit, yielding 80 per cent. bunches. Rich bottom lands that were beginning to give poorer and poorer results and yet are trenched, at once responded to a good application of lime.

All that is wanted, in addition of course to tillage, to make lands renew their youth, are (1) drainage, (2) humus, (3) lime.

The humus can be got by growing heavy crops of cowpeas, Jerusalem peas or overlook beans or Bengal beans, and the heavy crops of these can be secured by tillage aided by fertilizers, and as these legumes do not require nitrogen, they are economical. Nitrogen is the most expensive element in fertilizers.

Tillage, drainage, humus, lime, applied with knowledge and experience of different crop requirements will enable fine crops of any product to be raised. —Jamaica Agric. Soc. Journal.

LIME ON MOOR SOILS.

A. DENSCH.

One of the fundamental measures adopted in the improvement of moors is liming ; it has, however, frequently been observed that excessive applications of lime are injurious, so that now not more than 1,800 lb. per acre are given to arable land, whilst pastures and meadows, being less susceptible, may be given 3,000 to 4,000 lb. per acre.

The causes of this injurious effect are not yet well known. The writer has specially studied, in a series of laboratory researches, the behaviour of nitrogenous compounds in similar conditions, and has arrived at the following conclusions :—

I. The cause of the injury due to heavy liming on moor soil is connected with the nitrogen question.

II. The transformations of nitrogen in moor soils are essentially chemical, but a concurring bacterial activity is not out of the question.

III. In such moor soils, both limed and unlimed, losses of nitrogen, after a dressing with nitrate are observed. On the intensity of such loss lime does not appear to exert a determined influence ; these losses lower the utilization of the nitrogen but do not cause absolute deficiency of this element.

IV. Under certain conditions an active leaching out of nitrate from peaty soils that have been limed may cause considerable losses, which, however, are limited to cases of exceedingly unfavourable weather.

V. In decomposing moor soil nitrate undergoes a partial reduction to ammonia and this to a great extent when the soil has been heavily limed. As intermediate product nitrous acid may be formed ; this, however, may remain a fair length of time in the soil.

VI. It is highly probable that this formation of nitrites is one of the concurring causes of the injurious effects hitherto observed ; of course without excluding other possible factors.

VII. Besides the nitrites, probably some nitro or nitroso compounds are formed, and it is not impossible that they also may be injurious to plants.

Lastly, in order to avoid the reduction of nitric nitrogen an energetic tilling of the soil is recommended, so as to favour an active oxidation of the nitro compounds.—MONTHLY BULLETIN.

SYNTHETIC MILK FROM SOYA BEANS.

A factory for the making of synthetic milk from soya beans and other ingredients is shortly to be established in Liverpool. Soya beans contain 40 per cent. of "soluble casein" under conditions which admit of its ready utilization for the making of milk, which, as regards nutriment, is claimed to be equal to cow's milk, having a fat more easily assimilable than that of the latter. The company projecting to establish a factory in Liverpool is the "Synthetic Milk Syndicate, Ltd," London, and they will work according to DR. FRITZ GOSSEL'S process (of Stockheim, Essen, Germany). For the production 100 litres of milk the procedure is as follows: about 10 kilos of finely ground soya beans (or earth or pistachio nuts, or sesame or teal seeds or mixtures of same) are mixed with about 100 litres of water and a small quantity (above 5 gms.) of phosphate of soda or potash or the like, allowed to stand about an hour, and then slowly brought to the boiling point and only just allowed to boil; the liquid is then suitably filtered and the residue pressed after it has been cooled to about 50° C. About 2'4 kilos of milk sugar or other suitable carbohydrates, about 6 gms. of sodium chloride and 60 gms. of carbonate of soda are dissolved in the liquor run off, and about 2 kilos of sesame oil or any other suitable mixture of fats or oils are mixed with the solution. The milky liquor obtained would be brought to the volume of 100 litres by the addition of pure water. The "milk" can be manufactured at a cost which will admit of its being sold to dealers at 2*d*. per. quart.—MONTHLY BULLETIN.

FRUIT.

CITRUS CULTIVATION IN INDIA.

W. BURNS AND H. P. PARANJPYE.

SOILS SUITABLE FOR CITRUS CULTIVATION.

Citrus plants are very accommodating. Unless the surrounding conditions are exceptionally unfavourable the trees generally do fairly well in all soils. The suitability of the soil will be best understood if we know what the trees do not like. Heavy soils through which water does not percolate easily, or which are constantly moist, should not be selected. Similarly, very light soils in which water is not held for some time will not suit for citrus trees. Another condition which the trees will not tolerate is a layer of impervious rock at a short distance below the surface of the soil, and yet we have seen a plantation near Sinhagad where the surface soil was only three inches deep, and below that was hard compact murum. It is hopeless to expect success in citrus cultivation on such soil. In another plantation the rock was one to one and a half feet deep only. In both cases the plants were doing badly. In the case of a plantation where there is a depth of a foot or two of soil and then hard rock the plantation will do apparently all right for a year or two or even more, according to the depth of the soil. Then the flowers will commence to fall off on account of the unhealthy condition of the roots which have now struck the impervious layer. They can get no further, can draw on no fresh supplies of water and are liable to be in stagnant moisture in the soil above the rock. Soil which has become salt owing to over-irrigation without drainage is also fatal to trees as we have seen in our practical experience. So much for the soil conditions that are not suitable for the growth of citrus.

While dealing with soils we may remark that citrus fruits grow splendidly on the alluvial soils formed by the shifting rivers on the plains near St. Vincent's Gulf in South Australia. The rainfall there is about 20 inches. A rich deep red colour is got in the citrus fruit. Well and tank irrigation are practised. Citrus lands cost £50 per acre and upwards. Irrigation settlements along the Murray river in Australia are also places where the oranges do well.

Varieties of citrus grow upon the sticky adobe soils of Mesopotamia, upon the alluvial soils of the lower Mississippi, upon the fertile soils of the West India Islands, upon the dry soils of Arizona and California and upon the almost sterile sandy soils of Florida. There is probably no other genus of fruit trees in which the species are so plastic as to adapt themselves to almost every possible gradation of soil. It should not be inferred however that every variety of the genus can be grown upon all of these different kinds of soil. For it is absolutely necessary to choose the particular variety which is adapted to any peculiar soil."

CLIMATE.

As to climate we have already given a case of a successful orange garden in a place with a rainfall of 125 inches. Further data on the point from this Presidency are wanting except in the case of pomeloes which can certainly be grown in the Konkan with success.

The fact that oranges of excellent quality are grown on the Khasia hills in Assam in a very heavy rainfall ought to prevent us from making any assertion that orange cultivation will fail in a similar rainfall here.

THE STOCK.

Propagation by seed of citrus trees is not desirable in this part of country. We have seen by actual sowing of the seed of Nagpur Orange, Musumbi and Reshami oranges that seedlings of these plants are exceedingly thorny: in fact there is hardly any leaf without a thorn. On the other hand these same plants when budded on Jamburi or any other stock (although the stock may be thorny) do not produce thorns. After careful examination of fifty budded Santra plants we have found two plants having two thorns each. Musumbi plants do occasionally have thorns, but these are very rare and the plants may be said to be practically unarmed. Absence of thorns is a great advantage in this fruit tree as danger of puncturing the fruit is minimised, and harvesting the fruit is facilitated. Also digging, manuring and pruning can be done with less trouble.

We shall now point out the most essential characters in a stock for budding on. The stock should be of good round stem about half an inch in diameter. It often happens that a plant is put out in good soil, is receiving the best attention as regards water and manure, still it is not making good progress and never yields good fruit. It is difficult to account for its bad health. In such cases the trouble may be due to either bad scion or bad stock. Thus arises the necessity not only of budding but of choosing the right kind of stock and scion. Now to consider stock. Whatever stock you choose, collect the best fruits ripened on the tree and allow them to rot for some ten days. When sufficiently soft extract the seeds and bury the pulp in the manure pit. Of the seeds select only the plump and well developed ones. A good method of selection is to place the seeds in water. Those that come to the surface should be rejected. Those that go to the bottom are mostly safe for sowing. The seeds should be sown immediately, for their germinating power does not last long. The seeds should be sown either in boxes or beds that should be protected from the hot sun. Seedlings when about five inches high should be transplanted into beds. When transplanting, the main root should be cut short. This ensures good sound side roots and the removal of budded plants becomes much more easy. Seedlings should be transplanted at a distance of eight to twelve inches. This ensures sufficient space for budding operations, and also prevents much branching of the stock from the base. Young stock should be allowed to go straight and the lower ten to twelve inches should be kept clean of side shoots. The part above this should be allowed to branch freely. These branches serve to protect the scion from the heat of the sun. For budding purposes the stock should be about half an inch in diameter, with suitable watering and manuring. This condition will be reached in not more than

eighteen months. The bark should be easily separable from the wood, below it should be soft and pliable and the inside mucilaginous. The external colour of such a bark is deep green closely streaked with whitish grey lines. These conditions are found when the sap is vigorously flowing in the plant. When the bark cannot be easily separated from the wood below or when it is dry inside, it is futile to attempt to bud. Desirable conditions are to be seen in the stock in the beginning of the rain (June) and in the cold weather (December, January, February). Referring again to the stocks experimented with, the bark of Mahalung stock is somewhat brittle and less mucilaginous, and the sap-flowing condition lasts only for a short time. Reshami is not at all suited as a stock, for the bark closely adheres to the wood below, and is dry inside. With Pomelo as a stock the great difficulty is that it does not stand transplanting when about an inch in diameter. Nagpur orange stock when cut off above the bud in the usual way to force the bud to grow, often turns black above the bud, and this is a dangerous thing in a stock. The Jamburi stock is free from all these faults.

THE SCION.

In choosing the scion we must first have regard to the general character of the trees, and choose scions from a tree that is a heavy yielder of fruits of good quality. In choosing the actual branch from which to cut the buds we must look for the same characters of roundness, lack of thorns, and flow of sap as have just been mentioned in the case of the stock. Each bud is cut off by slitting the bark in a rectangle and round the bud half an inch above and below the bud and one-third of an inch to each side of the bud. It is then eased off and kept moist till insertion in the stock. The bud should be inserted on the stock about six inches from the ground. The cut for the bud is simply two cuts in the form of a T and a bark eased back to allow of the insertion of the bud. The bud is firmly tied in with *sopat*, i.e., the inner part of the plantain leaf sheath, and a small flap of *sopat* tied so as to shade the bud. After a month or less the bud begins to grow out into a branch. The stock is then cut off about six inches above the site of the bud, and the whole of the stock above the bud is cut off when the branch from the bud is eight inches long. After this, care must be taken to rub off all buds that show any tendency to develop from the stock below the site of the bud. At no future period must any part of the tree produce branches except the scion.

After the scion has produced a branch of not less than a foot long the plant may be transplanted into its permanent place in the field. The distance apart at which the plants should be put out is still a matter of debate. American authors recommend distances that seem enormous to those accustomed to the methods in vogue here. For example 25 feet is recommended as a suitable distance. We are not yet in a position to pronounce definitely on this subject but for the meantime we would recommend those who can experiment to do so by putting out groups of trees at different distances. The bulk of their plantations however should, until the question is settled, be planted at 14 x 14 feet in the case of Santras, and wider in the case of Musumbi and Pomeloes. In the case of Kagadi Limbu 10 x 10 feet will do. The pits for the plants should be three feet each way and the earth mixed with about 100 lb. of farmyard manure. It is desirable to support the tree in its new place by tying it to a stake till it gets hold of

the earth for itself. The scion branch should also be tied to the stake to prevent the wind wrenching it off. In planting, the bud should face the side from which the wind blows otherwise the tree will grow lopsided.

TREATMENT OF PLANTATION.

While the stocks have been grown and budded the soil of the plot selected for the permanent plantation should have been receiving attention. It should have been ploughed, harrowed and levelled. Care should be taken to remove all roots of Kunda (*Ischæmum pilosum*) and Hariali (*Cynodon dactylon*). Care should also be taken to dig out all nests of white ants in the field or in its neighbourhood and to destroy the queen ant in each case.

The pits should be made in the hot weather previous to the planting of the budded plants. If the soil be fairly good, intercrops such as brinjals, onions and chillies should be taken for two or three years between the citrus trees. After that time the citrus trees should have the whole plot to themselves. If the trees are very healthy they produce fruit in their fourth year but as a rule they should be cropped for the first time in the fifth year.

For trees which have already commenced to bear fruit the usual water supply should be gradually lessened when half the crop is gathered, so that by the time the last gathering of fruit is completed the surface soil is fairly dry. Two weeks after the last irrigation each tree should be carefully pruned of its dead and weakly branches. The whole plot should be ploughed or hand-dug and mixed manure of cow-dung, ash, household and village refuse should be given about three baskets to each tree. This manure should be thoroughly mixed with the soil and spread over the whole bed. The time of manuring the trees should be about 10 to 15 days before the first irrigation. The roots should be opened and young fibrous roots near the stem should be cut off. By the time the operations are completed the trees show a tendency to drop their leaves. In retentive soils considerable dropping of leaves is necessary, while in open elevated soils this is not absolutely necessary. The first watering should be scanty, just sufficient to moisten the upper surface of the soil. This stimulates the formation of flowers. Copious watering at the first irrigation tends to produce leafy shoots. The second watering should be given two days after the first; and the third watering four days after the second; and after that irrigation should be given in the usual manner according to the needs of the plants. On the fourth day after each watering, each bed should be hoed to produce a fine mulch on the surface of the soil. This is essential for conserving moisture in the bed. Cracks in the soil are thus prevented and young roots are not exposed to the heat of the sun.—Poona Agricultural College Magazine.

TALC AS A RENOVATOR OF DAMAGED RICE.

The Editor of the Queensland Agricultural Journal (August 1913), mentions the fact that powdered talc is used in the renovation of damaged rice. Old, discoloured, worm-eaten rice is said to be so treated that it takes on the appearance of new grain, which is said to be very injurious to native labourers in tropical countries where rice is the staple food.

This would seem to be a matter well worth looking into by our inspectors of food stuffs.

THE CO-OPERATIVE MOVEMENT.

TRANSFORMING INDIA.

The Co-operative Conference came to a close at Simla on Oct. 18th. The HON. SIR ROBERT CARLYLE said:—"Gentlemen, it is now seven years since I first attended a co-operative conference. We have moved fast since then, and the infant of 1906 is now a vigorous youth. During the past year the loans advanced to members have increased by a crore, while the membership of societies in India has increased nearly by 160,000 to a total membership of 573,000 including the families of members. There must now be 3,000,000 people directly interested in co-operative societies, while the total population beneficially affected is much greater. Where the co-operative movement is strong, the money-lender who wishes to keep his clients has to reduce his rate of interest and to show some consideration for his debtors. Taking this into account, at least 6,000,000 people are now benefited either directly or indirectly, by the co-operative movement. We assembled in this room knowing fully well that the co-operative movement means something very much more than the provision of cheap credit. Cheap credit is very important and, without it, material progress may often be impossible; but cheap credit, if given to a man not trained to its use, may prove his undoing —and it will prove his undoing if all the use he makes of it is to borrow more largely for unproductive purposes. Co-operation, if it is to be of permanent benefit, must teach the debtor how to use the money he borrows. We know even from our Indian experience how quickly a good society teaches this lesson, but for an object-lesson one has to go to a country like Ireland, where the co-operative movement, inaugurated and guided by SIR HORACE PLUNKETT, is transforming the country. A debtor cannot be made a new man by a stroke of the pen, but it is easy enough to get a number of cultivators to undertake to be jointly and severally responsible for the repayment of loans. It is constantly done by Government, and the device has enabled Government to lend more freely and to dispense with troublesome enquiries as to the security each individual can offer. It is a device which has served and will continue to serve very useful purposes. Co-operation by itself does little to teach the debtor, and this is why I have always urged great care in starting new societies, as we have to see to it that they are true societies, and not mere aggregates of individuals. We have to make sure that our foundations are well and truly laid and this involves great labour, but labour which is well repaid. The task on which you are engaged is a glorious one, for true co-operation will transform India. Where else can we find so strong an incentive to the now dumb masses to educate themselves? Where else can we find so admirable a training for local self-government? And remember, this is bound to react on the larger political life of India. It is to

co-operation again that we must all look for the speedy and effective introduction of agricultural improvements, as co-operative societies in some form or another will prove an effective link between the individual agriculturist and provincial agricultural departments. It is not for me to advise you, gentlemen, on the details of your work, but there are some general principles which I believe to be of universal application. You should strive for steady and not for spasmodic growth, otherwise the strain on the staff becomes very great and work cannot be really well done. Then again, every effort should be made to develop other sides of co-operation than the mere obtaining of money on moderate terms. Here I would note that I believe it will generally be found a sound principle to confine every society as much as possible to one kind of work, as this will conduce to simplicity of working, and is obviously of very great importance for many reasons, but most of all because it makes it so much easier for all members of a society to take an intelligent part in the proceedings. It is perhaps hardly necessary for me to add that it will often be desirable that many members of one society should also be members of another society having a different function to perform. Every great movement as it develops has its own difficulties which can only be dealt with by men who thoroughly understand the problems involved. At first enthusiasm and a thorough understanding of the general principles of co-operation would carry a man through, but this will soon cease to be the case in any province. At every turn fresh difficulties will present themselves as new lines of work open out, and even as old lines of work increase in magnitude. Take, for example, the question of financing societies. In the early days, the problem was a very simple one, but in some provinces the question will soon become one of considerable complexity. Joint-stock banks have been of great assistance in many cases in financing co-operative societies and they have understood their own interest as any large increase in the number of co-operative societies must in the end also greatly increase the business of joint-stock banks. I doubt, however, whether joint-stock banks will be able to give much help after a certain stage of development has been reached, as they cannot lock up any very considerable part of their capital in societies which are unable to undertake to repay large sums at short notice.

You may ask, "What is the rôle of Government in this great movement?" My answer is that its main functions are to do what is necessary to secure public confidence and to ensure that societies are run on sound lines. Self-help is the essence of co-operation, and nothing should be done to warrant co-operators looking to Government to help them when they can help themselves. If it were conceivable that Governments could be neglectful and indifferent, it would be less injurious to co-operation than too much kindness, but you all know that neglect and indifference will not be your portion and that no Government will be found wanting when its help is required—INDIAN AGRICULTURIST.

THE GERMAN SYSTEM OF HELPING FARMERS.

In the JAMAICA AGRICULTURAL SOCIETY JOURNAL it is stated that the report of J. R. CAHILL upon his inquiry, conducted at the instance of the British Board of Agriculture, into the agricultural credit and agricultural co-operation Systems of Germany has been issued in London as a Government Bluebook. The report itself fills 302 pages, a prefatory note 3 pages, and appendixes 210 pages. MR. CAHILL, in his prefatory note, says that in no modern state does organized effort for safeguarding and promoting the economic interests of agriculture appear to have been so persistent and successful as in Germany, more especially in the direction of providing the farmer with facilities for obtaining credit, for acquiring the instruments of production, and for disposing of his produce on the most favourable terms. In Germany landowners can obtain mortgage loans through a variety of special institutions for mortgage credit.

At present the total outstanding loans obtained through such agencies may be estimated at approximately £400,000,000. The goal of a co-operative bank loan in practically every parish of the whole monarchy has now been nearly reached. There are in Germany 17,000 agricultural co-operative banks, with a total membership of over 1,500,000. In 1910 the total turn-over of 14,729 such banks amounted to £254,668,800. In the sixteen years, 1895 to 1910, only nineteen rural credit societies were involved in bankruptcy.

INJURY DONE BY WEEDS.

On arable soil weeds are trespassers that should be prosecuted with the utmost rigour of the law. They are thieving vagrants to be expelled from the fields. The amount of water which is taken up by weeds and evaporated from the surface of the leaves is very great. For instance, an average mustard plant pumps from the soil about 14 oz. or seven-tenths or a pint per day; a sun flower 33 ozs., and so on. The transpiration is generally in porportion to the surface of the leaf, but thin leaves transpire to throw off water more freely than fleshy ones. Consequently, weeds having large leaf surface draw from the soil and give off through the leaves a large amount of water, and thereby rob the surrounding plants. Many botanists consider this waste of moisture the most serious injury done by the weeds.

Weeds naturally make use of the same food as the cultivated plants among which they grow. Consequently they deprive a crop of a large amount of the available nourishment; and they rob the succeeding crop as well. For example, an analysis of the Russian thistle by SNYDER showed that it contained from 12 to 17 per cent. as much nitrogen as there is in clover, and an ordinary thistle of this kind covering a square yard takes more potash and lime from the soil than two good crops of wheat from the same area.

Weeds often grow more vigorously than useful plants and, as a consequence, they shade or crowd, or partially choke the seedling of the desired crop. Black bindweed, for instance, often covers completely a large part of plants among which it grows.

In the treatment of weeds, it is emphatically a case of "a stitch in time saves nine;" they should be prevented from seeding whenever possible, and when buying seeds for sowing get them pure, so as to be certain that you are not sowing weed seeds.—AUCKLAND WEEKLY NEWS.

POULTRY.

EGG PRODUCTION FOR PROFIT.

J. C. NEWSHAM.

The following description of an English farm in Hampshire and the account of the methods that have been adopted by the proprietor to make egg production in this country successful, will be of interest to all who keep poultry for profit. The circumstances under which the farm was established are as follows:—The proprietor was perhaps one of the most successful of the large egg producers on Vancouver Island; two years ago he returned to England, purchased ten acres of farmed-out land, and commenced to build up a plant suitable for egg production on a large scale. The farm is run purely for profit, and is at present stocked with 1,600 White Leghorns. As regards housing, four large laying houses have been erected, each accommodating four hundred birds, while a brooder house for 2,500 chickens, and various houses for cockerels and other stock are provided.

HATCHING AND REARING.

Until recently half a dozen incubators were used on the farm each capable of holding 360 eggs, but the proprietor has now installed an incubator of a new type, capable of carrying many thousands of eggs, and of effecting a saving in fuel and labour.

Eggs are set for hatching from April 7th to May 1st, so that the pullets may commence laying in October. On the average, six per cent. of the eggs prove infertile, while the number of fertile eggs hatched usually reaches 75 per cent. One half of the flock is reserved for breeding purposes, and for the remaining half pullets are substituted every year. In order to accomplish this, it has been necessary, up to the present, to incubate 4,000 eggs in two hatches. Eight hundred pullets are reared annually for renewing the stock on the farm. Some 20,000 eggs are sold for hatching each year, and the price obtained is 5*s*. for each sitting of 15 eggs, 35*s*. for a batch of 110, and £15 for 1,110. The extra number of eggs is given in order to cover inevitable breakages and infertile eggs. A sitting of eggs from a first class laying pen of birds will, of course, be an expensive item. The proprietor of the farm in question states that he has paid as much as £5 for 100 such eggs.

BROODERS OR FOSTER MOTHERS.

The ordinary hot water type of brooder is held in no great favour on this Hampshire egg farm. The ventilation is said to be faulty, and requires continual adjustment to keep in proper order; there are numerous lamps which require attention; the cost of working the brooder is described as being excessive, and the initial cost is high, while a great deal of valuable time has to be devoted to the regulation of the temperature. On the farm in question the temperature in the brooder house is greater near the pipes than elsewhere, so that the chicks, if cold, go near them, and if too hot away from

them. This house is very large, and provides plenty of air space. Anthracite coal is used as fuel, and in order to attend to the fire properly, two visits in twenty-four hours are required. The proprietor estimates the actual cost of fuel at $\frac{1}{2}d$. per chick for two months.

The special type of brooder used on this farm has a capacity reckoned at 2,500 chicks. The brooder house is 110 feet long, 12 feet wide, and is divided into twenty pens, each 5 feet wide, and 8 feet long. There is a furance pit in the centre, 10 feet by 8 feet, and a passage at the back, 4 feet wide, running the entire length of the building, with doors at each end, and one door at the back opposite the furance, with removable windows in the doors. The floors are of boards, which are covered with sand and small litter to a depth of 3 inches. On the north side are six windows and the south side is of glass. Wire netting is used for the divisions and gates into the passage. In each of the twenty separate pens in the brooder house 125 chicks are accommodated, the number being gradually reduced by, say, twenty-five per cent. of deaths, and by the removal of a certain number of cockerels as soon as the sex can be distinguished, thus reducing the number of birds in each department as they grow in size. The birds actually remain in the brooder house for from six weeks to two months, according to the weather conditions; but in the case of White Leghorns, practically all the cockerels can be detected at two months, and quite a large number at from five to six weeks.

HOUSING ACCOMMODATION.

The farm itself is situated at an elevation of six hundred feet. The housing accommodation for the birds is a matter of difficulty, especially in the case of a commercial egg farm where large flocks have to be catered for. On the farm under consideration, the pullets are removed to small portable Colony houses when the laying houses are full of adult stock; and they remain there until they are about five months old. Each of the temporary colony houses is large enough to accommodate 50 birds. The floor is of loose boards, covered with earth and straw; the front is of wire, and there are three perches. These colony houses are 6 feet wide, 4 feet high in front, and 3 feet high at the back. They are built of timber, and covered with a patent roofing felt, and are portable. In short, they may be described as miniature laying-houses.

The permanent quarters for the adult fowls are much larger, each house being built to accommodate four hundred birds; they are 9 feet wide, 180 feet in length, 7 feet high in front, 4 feet high at the back, and are divided into a number of partitions at every 10 feet by a board running 6 feet across the floor. The houses are also fitted with glass fronts, and there is a wire covering under the hood to allow free circulation of air. There are perches at the back, fixed over a dropping board 2 feet wide and raised to a similar distance above the ground; the boards are covered with fresh earth every week.

In the front are placed removable nest boxes, and over these and under the hood are situated broody coops. At the north and south sides of the house are doors for hens, and the attendants can enter by means of doors

placed at the two ends of the house, and also at intervals of 30 or 40 feet along one side. Each house stands on one acre of ground, and the birds run on to the south half-acre in winter, and on to the north half acre in summer; and as soon as the plot of ground is vacated by the birds, it is immediately ploughed and sown with wheat and thousand-headed kale. The system of management ensures an adequate supply of fresh green food for the birds, and at the same time keeps the soil sweet and wholesome.

FEEDING.

The 1,000-headed kale is supplemented by an extra ½ acre or so of the same fodder crop which is grown every year and, if necessary, a few tons of roots, such as turnip, swedes or mangolds are purchased and scattered whole —not cut up—on the ground so that the birds can peck all the flesh out of them. The latter course is, however, only adopted when the green food is short in the yards. Fish or meat in a suitable form is always provided, to the extent of at least 10 per cent. by weight, in the dry mash, as a substitute for grubs, worms, and similar natural food. Ground raw bones are also sometimes fed but not regularly, for the supply of these is intermittent and an engine would be required to grind them at home which would involve a further outlay of capital.

The following statement indicates the general system of feeding as practised on this egg farm, (a) from the time of hatching until egg-laying commences, and (b) during egg production :—

(a) Chick food is given for one week, then chick food and dry mash. At three weeks a little wheat is introduced into the ration, and at five weeks all the birds are on wheat. The chicks have food before them continuously.

(b) During the period of egg production the birds are fed on a ration consisting of two-thirds of wheat and one-third of cracked maize. This is fed in 6 inches of litter in the morning, and dry mash food is always at hand for the birds. The latter are also provided with as much green food as they will eat, especially in the winter, as well as grit, shell, and charcoal.

The cost of feeding during the period from the time of hatching until egg-laying commences is roughly estimated at 2*d.* per bird; in the second case the cost of feeding during egg-production is a variable quantity to a certain extent, according to market fluctuations, but it is reckoned that from 6*s.* 3*d.* to 6*s.* 6*d.* per bird per annum is a fairly representative cost.

A good supply of clean, pure water is available, and in the present instance the proprietor is fortunate in having a continuous supply from the borough main, and if that fails he has at least 1,000 gallons always in reserve for his birds. Pipes are laid on to each house from the main, and short lengths of piping are also fixed under each house, with taps easily available at both sides. The taps are underground, and there is a length of piping screwed on and projecting above ground; the latter can be easily unscrewed, and, as the water runs out of the tap, which is below ground, it does not freeze. A little permanganate of potash is put into every drinking-dish that is placed before the birds.

CEYLON POULTRY NOTES.

Our Secretary, MR. C. W. JONES and MRS. C. W. JONES returned from their holiday on 22nd December and all members will be pleased to hear they have brought out with them a choice selection of poultry, not only for themselves but for other members of the Club.

Amongst the breeds are White and Black Leghorns ; White, Buff and Blue Orpingtons; White and Golden Wyandottes.

A few of these are very choice and selected from the best-known breeders in England, and there should be keen competition at the next show.

It is time the Club invited some fancier over from India to judge the whole show. A greater number of varieties of poultry will be penned at the next show than ever before, and an independent opinion would be welcome.

Saffron and roup powder mixed together and rubbed on the spots will be found a good cure for chicken pox, or tincture of Iodine applied with a feather.

Now is the best time to start hatching operations as the weather is more settled and favourable for the chicks.

For the first two days feed the chicks on hard-boiled egg and bread crumbs.

Do not continue the egg longer as it is liable to cause constipation.

A little Epsom Salts in the morning sop is good for the chicks, say once a week.

It is hoped the Show Committee will get a move on and let members know as soon as possible where and when the show is to be held.

TO THE HONY. SECRETARY, CEYLON POULTRY CLUB.

SIR,—One hears a good deal in these days about the "Agricultural Society wishing to work with and help the Ceylon Poultry Club to improve the breeds of poultry in Ceylon," and, of course, also to teach the public in general the higher methods of poultry keeping. Now, with the hope that this letter may be read by the heads of this department, let me suggest that the very best method of helping poultry culture in general would be the getting out from England of an expert, who should tour the Island for say a month, lecturing on poultry keeping and the proper breeds to keep. During his visit the Ceylon Poultry Club could hold one of their exhibitions, which are now becoming so popular in the Island; and our friend, (the expert) could act as judge of every class in the Show, and for a small fee tell exhibitors and visitors where their birds failed and suggest methods of mating whereby their poultry might be improved. I feel sure that not only the Ceylon Poultry Club, but many members of the public would give financial help, and that the actual cost to the Society would not be very heavy, while the benefit derived from such a visit would more than repay the cost.

Yours, etc.,
C. W. JONES.

THE LONDON DAIRY SHOW.

It may interest members of the Ceylon Poultry Club to read the opinion of a Ceylon man on the classes and exhibits at this well-known show.

This great exhibition was held as usual at the Agricultural Hall, London, on October 21st, 22nd, 23rd and 24th and was visited by five members of the Ceylon Poultry Club, namely: MR AND MRS. P. ASTE, MR. E. W. NAPPER, my wife and myself, and together we passed a most enjoyable day, making a very complete inspection of all the classes of fowls most popular in Ceylon. The opinion we arrived at at the end of a long day's work was that Ceylon fanciers have nothing to be ashamed of in their best Exhibits.

Many fowls that I have seen in the Ceylon Poultry Club shows were equal to or even better than 50 per cent. of the birds entered in the different classes. The winners were, as a rule, streets ahead of the remainder of the exhibits, and it was our opinion at the end of the day that in Ceylon Shows our judges are too ready to find small faults in birds that otherwise are really good. Type seems to be the first consideration, and this is undoubtedly as it should be—size and other details come afterwards. Taking (1) the Orpingtons: the size was good but nothing wonderful and not nearly as pronounced as I expected to see it.

Type was there in all the winners. The body was a more or less square block and the feathering was splendid, but, except in Blacks, shortness in leg was not so very marked and I think that some of our best Ceylon Black Orpingtons would have stood a very good chance of getting cards, if not getting into the prize money. The Blacks were the largest of all the Orpingtons, the Blues running them very closely.

The White Orpingtons were a very large class—55 cockerels and 63 pullets. The Whites seemed smaller than the Blacks or Blues, and even perhaps smaller than all the Orpington exhibits. They are quite a different type to the Blacks, lighter feathering and longer on leg. Speaking to a well known breeder and exhibitor of this breed, I was told that nobody has yet bred a White Orpington as short on the leg or as typical of Orpington type as the Blacks. MURRAY LINDNER was 1st in White Orpington Cocks, and even this bird was not absolutely the White I had expected to see, proving that it is not only in Ceylon we have to show cockerels with a slightly yellow tinge on wings and hackle. He was a grand bird. The hens were grand colour throughout. The prizes in this class did not all go to the big breeders.—1st and Championship.—ALAN. T. STOREY; 2nd, MRS. LYCETT GREEN; 3rd, 4th and 5th, MURRAY LINDNER.

Buffs were a grand lot making 105 entries in the two classes; W. I. GOLDING winning 1st and special for best bird in Show with a cockerel, and MISS M. MACLAREN 1st in pullets. What struck me most in the Buffs was colour, especially in the hens, which were all a beautiful dark buff.

White Leghorns: This was in my opinion perhaps the best class I saw. They were a splendid lot right through, both cockerels and pullets. The winning cockerel exhibited by MESSRS. WHITTAKER and TOOTHILL was a beauty, said to be only 4 months old, but he looked 7 at least. He was beautifully white with grand yellow legs, and a splendid comb, face and eye

but slightly yellow in lobe and just a sign of being a bit rough in the scales of his legs; comb has two small spikes in front, and four large wide ones, the centre one being in the middle of his head. This bird afterwards won 1st at Maidenhead and Liverpool and would, I imagine, have won at the Palace—only as his owner Mr. F Toothill was judging, he was unable to show. In White Leghorn hens Walter Bradley won 1st and 3rd, and Whittaker and Toothill 2nd and 4th. These birds were in the same position again at Maidenhead the following week; they were not the very long-legged coarse birds seen a few years ago, but were light racy birds with very thin not over large combs and nice sized lobes.

Black Leghorns in both classes seemed to me a poor exhibit, and Browns did not appear very wonderful, but there is such a lot to go into in judging Browns that only a really good judge can spot all the details and do them justice.

The Rhode Island Reds made a fine class of 154 birds in four classes—two for single and two for rosecombs. I don't wonder these birds are popular. They are certainly one of the handsomest varieties of modern poultry.

Wyandottes: These were another large class of 324 birds in all varieties. The White Wyandottes are quite a different type to what I have seen in the Ceylon Poultry Club Shows up to now, but two typical birds have just arrived both of them winners at Home and these should help to pull the Wyandotte classes in Ceylon shows up a bit.

The breeding pens were a sight, and oh! how we wished we had money enough to buy the lot. One class I think Ceylon could have won in and, that was White Japanese Bantams. I have seen better birds in Ceylon than the winner.

I went carefully into the Indian and Malay Game classes and although I know very little about these birds, I formed an idea that something was wrong with the Ceylon exhibits in this class of poultry. They are nothing like what one sees at Home. It is a great pity that Rajah, the famous Game Cock of Ceylon, that was bought by a few members of the Ceylon Poultry Club and shipped Home to appear at the Dairy Show should have died of a very bad attack of roup three weeks before the show.

I had this bird examined by experts at Home and their opinion was that he was not pure-bred. According to them his head was his only good point, all the rest being wrong.

To finish with, may I suggest that some wealthy member of the Ceylon Poultry Club or the general public, get out an expert on poultry breeding and to judge at one of our Exhibitions?

C. W. JONES.

FATTENING POULTRY.

R. V. MITCHELL.

The good points in a suitable table bird are (1) a well-shaped body, i.e., long and deep, with back and breast broad, legs short and well set apart; (2) good health; and (3) the ability to stand forced feeding in close confinement. Birds of this type should be selected from the flock and mated with similarly well-shaped male birds so as to build up a strain of reliable pedigree.

One of the most popular breeds of farm chickens is the Barred Plymouth Rock, a strong hardy bird laying as many eggs as any of the general purpose breeds. Birds with yellow skin and shanks are preferred in the best markets.

Young birds that have been allowed free range are not in good market condition, but having good body frames, they respond to feeding very quickly and will gain in weight from 25 to 40 per cent. in two weeks' time if properly cared for. The writer carried out experiment on different rations at the Pennsylvania Experiment Station during the fall of 1911, with the following results:-

1. Birds fed on corn meal and meat scrap moistened with water gained in weight twice as much as birds fed on shelled corn and meat scraps.

2. The addition of wheat to a diet of shelled corn and meat (maize) reduced the increase in weight.

3. Birds fed on corn meal and buttermilk and kept in a fattening crate gained in weight three times as much as birds fed on corn meal alone, and this gain was made at a cost of about $3\frac{1}{2}d.$ for each pound gained, whilst the cost of the gains of the birds fed on whole grain ranged from 1*s.* 3*d.* to 2*s.* 6*d.* for each pound gained

These results prove that whole grain does not fatten chickens and that the best results are obtained by feeding finely ground feeds to birds confined in crates.—MONTHLY BULLETIN.

"ELECTRIFIED" CHICKENS.

The most extraordinary of all the applications of electricity to intensive cultivation is the use of the electrical discharge in the raising of chickens, and MR. THORNE BAKER'S account of electrified chickens (in a paper presented to the Royal Society of Arts) reads more like a chapter in romance than in technology. The mortality of birds hatched in electrified incubators is said to be extremely small, and the chickens are ready for market in five weeks instead of three months. They thrive on less food, lose their shyness, sparks fly from their beaks when they peck at a finger held out to them—the owner of the finger feels a distinct shock, but the birds seem unaware that they are other than just ordinary chickens.—THE GARDENERS' CHRONICLE.

320 EGGS IN 365 DAYS.

A Correspondent who signs as "Would-be Small Holder" writing to the POULTRY WORLD of December last states that he has a White Wyandotte that started laying on October 24th 1912, and up to October 24th 1913, had laid 320 eggs. This, he thinks, a wonderful r cord. The bird has never been ailing or wanted to sit, and there is no possibility of his having made a mistake in the number, as he has kept a strict record, and booked the eggs down, with date, whilst it is the only bird he has that lays a white egg

ENTOMOLOGY.

XYLEBORUS COMPACTUS, EICHH: A BORER OF TEA AND COFFEE.

In October of 1913 the Entomologist received from Wattegama specimens of tea plants from the nursery and said to be attacked by shot-hole borer. The attention of the Entomologist was called to the fact that the plant had been attacked below the ground level. Fifty per cent. of the plants in the nursery were said to be attacked. Though the insect resembled *Xyleborus fornicatus* Eichh (Shot-hole Borer of Tea) it was at once seen to be a different species. It is much smaller, the female being about 1·75 m.m. in length as against 2·25 m.m. in *X. fornicatus*.

The colour of the adult female is black.

The males are much smaller than the females and are light brown in colour.

Structural differences from *X. fornicatus* are not obvious.

In the latter the hair on the front of the head is better developed, and the posterior region of the thorax is smoother.

The insect works in a different way from *X. fornicatus*.

The tunnel from the outside leads into the centre of the stem and there a chamber rather than a gallery is excavated upwards as well as downwards for a short distance.

The walls of the chamber are of a black, charcoal-like colour, and the wood in the region of the boring and for some considerable distance from it is stained of a blackish hue. Patches of a white substance occur on the walls of the tunnel.

The insects in each tunnel are much more numerous than in the case of *X. fornicatus*. The following is the record of the chambers examined :—

No. of Gallery.	Female.	Male.	Immature.	Total.
1	1	0	25	26
2	34	2	13	49
3	28	2	25	55
4	7	1	4	12
5	28	2	29	59
6	32	1	21	54
7	41	3	12	56
8	28	2	32	62
9	1	0	0	1
10	1	0	45	46

The above table suggests that the insects in each tunnel are the offspring of a single female.

The great preponderance of females over males, 201 to 13, or 15·5 to 1 will be noted.

In the Tropical Agriculturist of January, 1912, Mr. Green refers to this species and remarks that it had been found in the living stem and branches of tea.

He was probably referring to examples which were submitted to him in October, 1906.

The following is a summary of the entry in his journal under date October 26, 1906 :—

The specimen came from Bandarawela. They had been attacking young tea plants. The galleries ran longitudinally up and down the pith of the plant. with a single transverse circular gallery at point of entry. The galleries seemed to be more densely crowded with insects in all stages (compared with *X. fornicatus*). In every case the plant had been killed at the point of attack, the root remaining healthy and the upper part of the stem often still green (in cases of recent attack). The point of attack was just above the collar.

In September, 1911, Mr. Green received specimens of a *Scolytid* from Pelmadulla where they had been attacking Coffea robusta.

Green regarded them as "almost certainly *X. coffeæ*," remarking that that pest had not previously been recorded from Ceylon.

I could find no difference between these beetles and those attacking tea and referred to above, and, on submitting them to Mr. Guy Marshall, I was informed that Col. Winn Sampson had identified them as *X. compactus*, Eichh.

It will thus be seen that this beetle occurs in Ceylon in these widely separated localities. No doubt it occurs elsewhere and is mistaken for Shot-hole Borer.

A lookout should be kept for it and the attacked plants or parts of plants destroyed.

A. RUTHERFORD.

SOME NOTES ON XYLEBORUS FORNICATUS, EICHH (SHOT-HOLE BORER).

Though burying of prunings has been for some time and is at present the prevailing method of control against *Xyleborus fornicatus*, Eichh, I have been able to find reference to but one experiment to determine whether, in fact, the beetles are killed by the burying or are unable to reach the surface of the soil

This one experiment was conducted by a correspondent of Mr. Green in 1902. In the course of a letter to Mr. Green he stated that he found, by experiment, that all of the larvæ and a large percentage of the full-grown borers were destroyed by burying the tea branches with basic slag.

I have recently made several experiments in the laboratory with a view to determining this point and in this article I propose to set forth the results.

But first it will be of interest to get some idea of the life-history of the insect, regarding which some crude and fantastic ideas are current. For this purpose I shall give below the records of examinations of infested twigs made at Peradeniya in September and December, 1913.

The September examination was made on the 20th, the twigs having been cut from the bushes on the previous night.

The beetles do not readily leave freshly-cut twigs, and it is improbable that any escaped in the interval.

Each entry represents an entrance hole.

TABLE I.

	Adult		Pupa		Larva.	Egg.
	Female	Male.	Female	Male.		
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	2	1	0	0	0	0
4	3	1	0	0	1	0
5	1	0	0	0	0	0
6	3	1	0	0	0	0
7	0	1	0	0	0	0
8	1	0	0	0	0	0
9	0	0	0	0	0	0
10	1	0	2	1	7	0
11	1	0	0	0	0	0
12	1	0	0	0	9	8
13	1	0	1	0	10	7
14	0	0	0	0	0	0
15	1	0	0	0	0	0
16	1	0	0	0	0	0
17	1	0	0	0	4	3
18	0	0	0	0	0	0
19	3	2	1	0	0	0
20	0	0	0	0	0	0
21	1	0	0	0	0	0
22	1	0	0	0	0	0

In all probability Nos. 5, 8, 11, 15, 16, 21 and 22, where only a single female was present, represent colonies just starting; in several of these cases the gallery was quite extensive.

Nos. 10, 12, 13, 17 probably represent colonies in full vigour, while Nos. 3, 4, 6, and 19 represent colonies that would soon have flown.

The condition of No. 7 suggests that the males may wander about, this one having entered the gallery by mistake.

The December examination (*vide* Tables II. and III.) reveals much the same conditions. The twigs were collected on the nights of the 15th and 18th and examined on the mornings of the 16th and 19th respectively.

It will be observed that the proportion of males to females as revealed by these records is 12 to 60, i.e., 1 to 5.

In the case of another and larger count there were found to be present 40 males and 490 females, i.e., 1 to 12·25; (these were all taken from a single badly infested piece of a tea-stem, forwarded from a district that has long suffered from Shot-hole Borer).

TABLE II.

	Adult		Pupa		Larva.	Egg.
	Female	Male.	Female	Male.		
1	1	0	0	0	0	0
2	0	0	0	0	0	0
3	1	0	1	0	5	1
4	1	0	0	0	0	0
5	1 dead	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	3	1	1	0	1	0
9	1	0	0	0	1	1
10	1	0	0	0	0	0
11	1	0	0	0	4	3
12	1	0	0	0	5	3
13	1	0	0	0	0	0
14	2	1	0	0	0	0
15	0	0	0	0	0	0
16	1	0	0	0	6	1
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	1	0	1	0	8	1

Gallery No. 16 was exuding a bad-smelling, semi-liquid substance and Dipterous larvæ were present.

TABLE III.

	Adult.		Pupa.		Larva.	Egg.
	Female.	Male.	Female.	Male.		
1	1	0	0	0	0	0
2	1	0	0	0	0	1
3	1	0	0	0	2	0
4	1	0	0	0	5	1
5	1	0	0	0	1	0
6	1	0	6	0	0	0
7	1	0	0	0	0	0
8	1	0	0	0	2	0
9	1	1	0	0	2	0
10	4	1	0	1	2	1
11	1	0	0	0	4	1
12	1 (dead)	0	0	0	1 (dead)	0

Ten galleries, which contained no insects, have not been entered in the above table.

It will be observed that the number of immature insects in each gallery, while it runs from 6 to 10 in a vigorous colony, may be as high as 17 or 18.

In none of the empty galleries were any remains of insects observed, so that it would appear that, if the foundress of a colony dies in her burrow, her work of rearing a brood accomplished, she must rapidly fall a prey to the mites (Tyroglyphus ?), which are not uncommon in the deserted burrows.

On the morning of September 20th, several beetles were placed at the bottom of a glass tube, about 2 inches in diameter, and fine earth was put in on the top of them to a depth of nine inches.

The tube was darkened by wrapping round it a piece of carbon paper,

On the 22nd several beetles were wandering about on the top of the earth.

On the 29th, several beetles were still alive ; they had lived nine or ten days without food.

It is evident that nine inches of fine earth proves no formidable barrier to the emergence of the beetles.

On September 30th, I placed several pieces of tea branches presumed to contain living borers in each of two glass cylinders, one of which was about four inches in diameter and the other about three inches in diameter. The lower end of the cylinders was covered in one case with muslin in the other with gauze cloth folded double. On the top of the pieces in the larger jar I placed 7 inches, in the smaller jar 5½ inches of fine soil and darkened the cylinders as in the previous experiment.

On October 1st, a beetle was observed at the surface of the soil in the smaller cylinder.

It subsequently disappeared and none were seen till the 15th, when I unearthed the pieces (in the smaller cylinder) for examination. Adult females and males, pupæ and larvæ were present and alive and vigorous.

Holes had been eaten in the muslin (and this was subsequently found to be so in the gauze also), and probably several beetles had made their escape by that route.

I replaced the unopened twigs and put in fresh soil.

On the 22nd, two beetles appeared on the surface of the soil ; on the 24th three were present, two of them dead ; one was alive on the 28th.

Beetles had appeared on the surface of the larger cylinder on the 17th.

On October 30th, I turned out the contents of both cylinders for examination.

The twigs showed a growth of white fungus in minute spots, and below the bark the wood was almost black in colour.

Nevertheless beetles were still present and thriving, as the following table shows :—

TABLE IV.

	Adult.		Pupa.		Larva.	Egg.
	Female.	Male.	Female.	Male.		
1	1	0	1	0	1	0
2	2	1	0	0	2	0
3	2	1	0	0	0	1
4	0	0	0	0	3	3*

* These eggs were located in a little side-pocket off the gallery, which is unusual.

Several dead beetles were found in the soil and in one gallery two dead females.

Near the surface of the soil were two females alive and vigorous.

Of the beetles taken from the galleries at the close of the experiment and kept in a tube without food one was still alive on November 13th, i.e., it had lived 14 days without food.

It is worthy of note that the fungus which provides the insects with food thrives living saprophytically.

So far no substance had been buried with the twigs.

On October 30th, using the same cylinders I buried twigs, presumed to contain living insects, with slaked lime.

Nine twigs were introduced into each cylinder and were covered with soil well mixed with slaked lime. Then fine soil was introduced so that the surface level stood at 5 inches in the smaller cylinder, and at $6\frac{1}{2}$ inches in the larger jar.

The lower end of one of the cylinders stood on a plate of glass, the other on a tin lid.

Light was excluded.

Adults, larvæ and eggs were found to be present in twigs gathered at the same place and time.

No beetles having been seen at the surface by the 8th of November it seemed probable that the slaked lime had been too much for them.

Accordingly the contents of the 5-inch cylinder were turned out for examination. Three pieces were examined and beetles and larvæ were found to be present and alive.

The remaining pieces were returned to the cylinder.

On the 13th, they were again examined, when adult females, larvæ and eggs were found to be present.

On the 18th, a beetle appeared on the surface of the $6\frac{1}{2}$-inch cylinder and on the 21st the contents were turned out.

No beetles were found in the soil but living beetles were still present in the twigs 1, *Vide* Table V.

TABLE V.

	Adult.		Pupa.		Larva.	Egg.
	Female.	Male.	Female.	Male.		
1	3	2	0	0	0	0
2	1	0	0	0	0	0
3	2	1	2	1	6	0
4	0	1	0	0	0	0
5	1 (dead)	0	0	0	0	0
6	2	1	0	0	1	0
7	3	1	0	0	0	0
8	1 (dead)	0	0	0	0	0
9	1	0	0	0	6	0

Slaked-lime had failed to kill even the larvæ after an exposure to it of twenty-three days.

On November 28th, twigs presumed to contain living beetles were buried with quicklime in two lots, one under 7 inches of fine soil, the other under 5½ inches of soil.

Many galleries in twigs gathered at the same place and time as the above were empty ; in others all stages of the insect were represented :—

TABLE VI.

	Adult.		Pupa.		Larva.	Egg.
	Female.	Male.	Female.	Male.		
1	1	0	0	0	0	6
2	1	0	0	0	0	2
3	1	0	0	0	4	2
4	1	0	0	0	10	0
5	2	1	1	0	6	2

On December 5th, one gallery from the 5½-inch cylinder was cut open and a male and female found alive and quite healthy.

On December 9th, a female appeared on the surface of the 5½-inch jar. (This may have been the female referred to above which had been returned to the cylinder.)

On December 12th, the rest of the twigs in this cylinder were examined and yielded the following, alive : —

TABLE VII.

	Adult.		Pupa.		Larva.	Egg.
	Female.	Male.	Female.	Male.		
1	1	0	0	0	0	0
2	1	0	0	0	0	0
3	1	0	0	0	1 (dead)	0
4	1	1	0	0	2	0
5	1	0	0	0	0	0
6	2	1	0	0	2	0
7	1	0	0	0	0	2

These ten beetles were placed among the quicklime at the bottom of the cylinder and the earth replaced.

On the 15th of December only three beetles could be found, one of which was alive. As the cylinder was not quite tight at the base, owing to soil having got underneath the edge, the beetles probably escaped by this route.

On December 19th, no beetles having so far been seen on the surface of the earth in the other cylinder, I examined two pieces.

The gallery in the first piece was empty ; it went in but a short distance and was probably empty when put into the cylinder.

The gallery in the other piece contained two females, two males, one female pupa and three larvæ.

The wood was dark in colour through decay.

On the 20th, two female beetles were got on the surface one alive and the other dead ; they were removed.

On the 23rd, a female was got near the surface, dead.

On the same day the remaining twigs were examined.

The wood was very dark in colour and cut like cheese.

Several galleries were empty but in none were dead beetles found.

Living beetles were found as follows :—

TABLE VIII.

	Adult.		Pupa.		Larva.	Egg.
	Female.	Male.	Female.	Male.		
1	2	1	0	0	0	3
2	1	0	2	0	11	0
3	1	0	0	0	0	0
4	2	1	0	0	0	2

It will be observed that larvæ and even eggs were present. From the above experiments it is seen that, under laboratory conditions, the beetles will continue to breed in prunings that are far gone in decay, provided these are not too dry, and even in the presence of slaked lime or quicklime, and that they are able to work their way up through as much as $7\frac{1}{2}$ inches of fine earth.

At certain times prunings buried under estate conditions will be subject to heavy rains, and I am not at present in a position to say how this factor will modify the results given above.

On the other hand the prunings in these experiments were probably more securely buried than prunings will be under estate conditions.

I have not tried basic slag nor sulphate of potash, but I know no reason for thinking that they will accomplish what quicklime failed to do—viz, killing the insects.

However, I shall be glad to receive and examine prunings that have been buried under estate conditions.

The depth at which they had been buried, the substance (basic slag quicklime, etc.) used, the length of time they had been buried, and any other fact likely to have a bearing on the result, should be clearly stated.

The following record is of considerable interest.

It is that of prunings cut on the 17th of December and collected from the plantation, where they lay as they had been cut, on the 30th of December ; the weather during the interval was dry.

TABLE IX.

1.	1 female (dead)	12.	0	22.	0
2.	0	13.	1 female (dead)	23.	1 female (dead)
3.	0	14.	0	24.	0
4.	1 female (dead)	15.	0	25.	0
5.	1 female (alive)	16.	1 female (alive)	26.	0
6.	0	17.	2 female pupæ	27.	0
7.	0		(1 alive, 1 dead)	28.	0
8.	0	18.	0	29.	0
9.	1 female (dead)	19.	0	30.	0
10.	0	20.	0	31.	2 females (dead)
11.	1 female (dead)	21.	0	32.	0
				33.	1 female (dead)

It will be noted that the above table shows a large number of galleries that contained but a single female.

It is very likely that these were insects that had just made their galleries preparatory to egg-laying, and that instinct did not urge them to quit their desiccated galleries. Had they exhausted their stock of fungus?

It is seen, too, that not only adults but even pupæ may remain alive in prunings left on the surface of the ground, for as many as thirteen days.

A. RUTHERFORD.

(*To be Continued.*)

ANT REPELLENTS.

Readers who inhabit ant infested countries may be glad to know that, according to the investigations of Messrs. W. NEWELL and T. C. BARBER on the Argentine ant (U. S. Department of Agriculture, Bulletin No 122), dry corrosive sublimate may be used to prevent ants from making their way on to the tables, chairs, shelves, and other furniture of dwelling-houses. The method of use is to soak cotton tape an inch wide in a saturated solution of corrosive sublimate, allow it to dry, and then fasten it around a table-leg or on the edge of a bookshelf, etc. If the tape remains dry it serves for months as a repellent to ant invasions.—(GARDENERS' CHRONICLE, 8 NOV. 1913).

SALT AS A MANURE.

In SÖDERBAUMS' experiments at Stockholm it was found that the application of common salt to oats caused a considerable increase in the yield in those cases in which nitrogen was given as nitrate of soda or sulphate of Ammonia, but not in the form of Ammonia chloride. No injury due to manuring with common salt was observed. The results seem to justify the conclusion that where potash and phosphoric acid are present in sufficient quantity, and the water requirements of the plant are met, the increase yield by the addition of salt is to be traced to direct manurial effect, especially in respect of the Chlorine part of it.—(INTERNAT. INST. OF AGRIC. BULLETIN).

GENERAL.

THE ALL-INDIA AGRICULTURAL CONFERENCE.

HELD AT COIMBATORE, DECEMBER 6th-13th, 1913.

The Agricultural Conference for all India which I had the privilege of attending last December on the invitation of the Agricultural Adviser to the Government of India, and with the sanction of the Finance Committee of this Society, was held at Coimbatore Agricultural College. It began on Monday the 8th and was concluded on Saturday the 13th December.

The proceedings opened with an address by SIR JOHN ATKINSON (representing His Excellency the Governor of Madras) who welcomed the delegates from all parts of India and briefly outlined the work of the Madras Department of Agriculture.

MR. JAMES MCKENNA, Agricultural Adviser to the Government of India, followed and described the progress and extension of the Imperial Department of Agriculture since the last Conference held two years before at Pusa.

The Board next appointed a number of sub-committees to report upon and make recommendations on the various topics appearing in the agenda. These sub-committees went fully into all the available information on each subject, threshed out bulletins and other publications issued by the different provinces, and drew up reports embodying definite resolutions to be submitted to the Board. In the meantime the programmes of work drafted for the various provincial departments and the native states were duly discussed and decided upon.

The reports of the sub-committees were then brought up in rotation according to the agenda for the day and, as a rule, formed the subject of much discussion before the resolutions in their final form were adopted.

In this memorandum I propose to transcribe from my notes on the more important subjects considered from a local stand-point.

RICE.

Under the head of *Rice* there was a large mass of information available.

In Madras the question of paddy manures has received very careful attention, and the conclusions arrived at by MR. W. H. HARRISON, the Agricultural Chemist, as summarised below, are deserving of consideration :—

The tendency of paddy cultivation under irrigation is to produce a heavy soil in which the soil particles are closely compacted. It is advisable to correct this tendency, and in order to do this, manures containing large quantities of organic matter capable of increasing the humus content of the soil should be employed.

Green manures (e.g., *Sesbania aculeata*, *Tephrosia purpurea*, *Crotalaria juncea*) are therefore to be recommended since the experience gained on the Coimbatore College Farm points to the conclusion that a bulky organic manure produces better crops than a manure supplying little organic matter though approximately of the same manurial value.

The leguminous green crops are specially valuable as nitrogen suppliers and may be imported to the land or, where possible, grown upon it.

The practice of applying leaves and twigs gathered from waste land (as done in the Jaffna peninsula) is commended.

The addition of a phosphatic manure, such as bone meal, to green manures (say, at the rate of 1 cwt. per acre) is advised. Potash manure need only be added if it is ascertained that the soil is deficient in this ingredient.

There are other fertilisers of a bulky character such as castor cake and fish, but green manures are on the whole most satisfactory and economical. The addition of a phosphatic fertilizer to oil-cake is generally an advantage, and the deficiency of potash in fish has to be made up.

Of artificial preparations Ammonium Sulphate and Cyanamide are suitable to paddy, but their use will depend entirely on the question of cost: and it should always be remembered that organic matter in bulk is a fundamental requirement of the paddy crop.

Nitrates are unsuitable for paddy since the fermentation that takes place in paddy soils is anaerobic with the production of Ammonia (which the plant readily assimilates) in place of the nitrates produced by aerobic fermentation in normal soils. A deduction made by MR. HARRISON, which has an important bearing on the question of tillage is that there is no need to alter the existing anaerobic condition. In this connection it may be mentioned that DEPUTY DIRECTOR HILSON's experience leads him to say that cultivating the soil in the dry season causes a reduction of yield; while DR. COLEMAN of the Mysore Department of Agriculture is disposed to agree with this view.

A series of trials in the use of green manures for paddy is down in this year's programme of work for our Agricultural Instructors. In many places *Crotalaria juncea* (Sin. Hana.) is likely to prove suitable. The crop matures in about 10 weeks and should be sown about two months before preparing the land for sowing paddy. Under necessity Crotalaria seed may even be sown among the standing paddy crop, so as to come up after the latter is harvested. The plant can be cut for fodder and the stems left to develop new foliage for turning into the soil. Where there is a demand the stem fibre can be prepared by retting, and sold to fishermen for net-making as is done in the Chilaw district. At present the only place where sunnhemp is valued as a green manure, raised *in situ*, is the Jaffna peninsula.

At Sivagiri Farm, which I have visited, it was found that as a result of growing sunnhemp the yield of paddy was increased from 2,000 to 3,400 lb.

It must be remembered, however, that such results could only be secured by systematic manuring over a series of years and not by spasmodic and intermittent efforts.

As regards seed the general experience has been that the rate of sowing is much too high and is capable of reduction to 30 lb. per acre in broadcasting: while 1/5th of an acre sown with about 20 lb. of seed is sufficient to plant out an acre. The question of how many seedlings should be planted per hole and the distance apart at which they should be planted must be worked out for each district. Three seedlings per hole at a distance of 12 in. apart would seem the maximum, but where time and other conditions permit the planting of single seedlings at half that distance is to be recommended as the most economical and satisfactory method.

I may here mention that the Society is conducting a number of experiments in connection with transplanting and these will be repeated at different centres.

With a view to improving the quality of the seed paddy and thereby the yield of crop it was recommended that cultivators should be encouraged to select the heaviest heads at harvest time and reserve these for seed purposes.

Itinerating inspectors should give special attention to this matter. The object of such seed selection, and of scientific work in plant breeding, should be the production of improved strains of the more important varieties found under cultivation in the chief rice-growing tracts. A further development of this idea of seed improvement is the establishing of seed farms for supplying improved seed paddy.

As a preliminary step towards a complete botanical classification of rices (of which no less than 1,182 named Indian varieties have been collected) it was suggested that an agricultural classification should in the first instance be made for each province.

The Society has just initiated an agricultural survey of our local paddies, and the Instructors are making a collection of herbarium specimens of all named varieties for the Agricultural Department.

CO-OPERATIVE SOCIETIES.

During the past year the loans advanced to members of Societies in India have increased by a crore of rupees, while the membership has risen by 160,000 to a total of 573,000. It is computed that there are now three millions of people directly interested in Co-operative Societies, while the total population beneficially affected by these Societies is probably six millions.

The advance in the development of Co-operative Societies began in 1912 when an act was passed removing the limitation preventing them from doing more than supply funds to members, and allowing of the formation of Societies with other profitable objects in view.

The sub-committee dealing with the question of bringing improvements to the notice of the cultivator, emphasised the importance of the Agricultural Department working through organised bodies and referred to Co-operative Societies as being specially useful in this connection. They have been utilised for the dissemination of agricultural literature, and for supplying seed and manure and implements; but the principle of co-operation has also been successfully applied to dairying in Nagpur and Benares, while in the Rampur district a co-operative cattle-breeding society has been established on a sound financial basis. Indeed there was ample evidence to indicate the various ways in which Co-operative Societies can help in bringing agricultural improvements into practice to the mutual advantage of the societies, as such, and the individuals belonging to them. While advising that developments of this kind are to be encouraged, the sub-committee made it clear that a Co-operative Society must maintain its character as a business concern and should not undertake agricultural propaganda-work for its own sake: also that caution should be exercised in undertaking anything that will not be found productive to the Society though profitable to the members individually. It is advised that there should be close association between the Registrar of Co-operative Societies and the Agricultural Department.

The establishing of private Central Banks for giving financial aid to Co-operative Societies has greatly facilitated the formation of the latter.

As a singular instance of the power of co-operation the Director of Agriculture in Mysore reported an interesting case where damage done to crops by a caterpillar was effectively checked by school children who collected 20,000 moths in the campaign against the pest.

AGRICULTURAL EDUCATION.

The sub-committee to whom this subject was entrusted submitted a lengthy report which dealt chiefly with the curricula of agricultural colleges. They also recommended that outside these colleges provision should be made (1) for short courses to be given in the vernacular on any farm where adequate supervision is available, and (2) for agricultural school courses under the supervision of the Agricultural Department. In connection with the latter proposal, reference was made to a successful experiment carried

on by Dr. Mann, of the Poona Agricultural College, who has started a vernacular agricultural boarding school capable of accommodating 50 boys, 14 to 16 years of age. The boys live under normal rural conditions and are taken through a two years' course of practical agriculture.

So far no serious attempt appears to have been made to bridge the gulf that separates the cultivator of the soil from the agricultural expert, so as to prepare the former for the teachings of the latter. What is required is to awaken in the village youth a real interest in his surroundings by developing his powers of observation; to give him a bent of mind appropriate to him as a unit of an agricultural population and to train him in intelligent and systematic methods of work which after all form the basis of Scientific Agriculture: for if we do not lay a foundation upon which to build we must inevitably be confronted with the baffling task of having to construct both foundation and superstructure at the same time.

It was mentioned at the Conference that time should be given for the cultivating class to realise the necessity for a training in agriculture after seeing the result of the work carried on by the Department through its agricultural farms. But an organization through which to work already exists in our village schools, and in the children attending them we have the most promising material to work with since we get them at an age when their minds are plastic and receptive. The mistake often made is to try to give them a smattering of agriculture, and a suggestion to this effect made at the Conference was naturally scouted by the Director of Education. The term Nature Study is perhaps unfortunate in its vagueness, and Dr. Coleman remarked that to some minds it suggested "a mass of scientific twaddle and sentiment rolled into one sickening whole!" If it signifies any of the sort the sooner the expression is dropped the better. But the fact remains that the School Garden system, wherever it has been tried, has proved an efficient means of discipline and education; and in respect of the latter "it is the influence rather than the instruction, the interest and inspiration rather than the facts that are to be desired."

I think, we in Ceylon, are working on the right lines for the East; and the work done during the past 10 years through School Gardens has justified the departure from the beaten track. In a memorandum I submitted for attachment to the report of the sub-committee on agricultural education at the Conference I sketched the lines along which the work was carried on in Ceylon, and indicated the progress made up to date.

The excellent training now provided for our Government teachers is calculated to equip them for the work they will be expected to do under the new order of things: while the rural agricultural schools it has been decided to open will provide the next step in the evolution of a new type of village youth. These schools of practical agriculture would correspond to the one which Dr. Mann has so successfully established in the Bombay Presidency.

The only province of India that is following the lines adopted by Ceylon is Burmah where through the initiative and enthusiasm of one of its officials (Lt.-Col. Cronin) a few school gardens have been established. These, according to Mr. H. Clayton, the Director of Agriculture in Burmah, have aroused great keenness, and the parents of the children are co-operating to make the movement a success. I have suggested the advisability of his sending over a few young men to be trained for the work of supervising these Gardens and developing the movement.

SUGAR.

I do not propose to say anything on this subject which is not of present importance to us, except that the work being done for the improvement of the cane sugar industry in India is of a high order.

Dr. Barber, late Government Botanist, Madras, has been appointed sugar-cane expert, and the cane breeding station at Coimbatore is well worth a visit by anyone interested in the industry.

SOIL DENUDATION.

The report of the Committee on this subject did not add much to the information available. The chief recommendations for preventive measures against erosion were the construction of terraces, contour drains with catchment pits, and the growing of cover crops along the line of terraces.

The papers I have brought with me on (1) Cattle breeding, (2) Food and Fodder supply, (3) the Prevention of Cattle Disease, and (4) Dairying, I have forwarded to the Government Veterinary Surgeon as they deal with matters belonging to his department: and the Society will no doubt welcome a paper from Mr. Sturgess, at some future meeting with reference to these important questions.

AGRICULTURAL STATIONS.

The most valuable work of the department is undoubtedly being done through agricultural farms. The demonstrations by our Instructors are made on small areas in co-operation with cultivators, and though this is a good plan as far as it goes it is desirable that larger areas should be worked with a view to arresting the attention of a wider circle of cultivators and securing more reliable records. In a memorandum submitted to the Director of Agriculture I have offered suggestions for establishing and working demonstration paddy fields.

In the Madras Presidency there are eight farms on which the advantages of better tillage, transplanting, seed selection, etc., are being proved in a practical and striking manner; so that these institutions serve as centres for the spread of agricultural improvements.

Facilities were provided for the delegates visiting these stations, about which I append a short note :—

(1.) Taliparamba, Malabar side; chief crops—rice, ground-nut, sugar-cane, pepper and ginger.

(2.) Manganallur, Tanjore—rice, sugar-cane.

(3.) Palur, South Arcot—rice, ground-nut, cotton, maize and sugar-cane.

(4.) Koilpati, Tinnevelly district—cotton and fodder crops.

(5.) Hagari, Bellary—cotton and sorghum.

(6.) Nandyal, Kurnoot—cotton, sorghum and Italian millet.

(7.) Samalkota, Godaveri—rice, sugar-cane, turmeric.

(8.) Anakapalli—sugar-cane, rice and maize.

The Coimbatore College farm which is the Central Agricultural Station for the Presidency is 480 acres in extent, consisting of flat land intersected by a stream coming down from the hills on the north, behind which the Nilgiri range rises to 8,000 and 9,000 feet.

On the wet lands irrigated by a tank, experiments are in progress to determine the most economical method of planting, the manurial requirements of paddy, the value of commonly available manures, &c., the work being conducted by the Government Botanist, Mr. Parnell, who has also established a large number of variety plots under observation.

On the dry land large areas are devoted to fodder sorghum for feeding the dairy stock. The typical black soils are reserved for cotton. Bengal gram (*Cicer arietinum*) is another dry land crop.

On the garden lands (i.e., well-irrigated) tobacco is one of the chief crops.

The Students' Gardens, cultivated solely by themselves, contain plots of most of the common crops of the Presidency.

It will thus be seen that the work of the farm is extensive but, what is more important, it is also efficient.

Attached to the College is a Botanic Garden, a dairy, Veterinary hospital and implement museum, all of which contribute to the education of the students under training.

CONFERENCES.

After attending a Conference, such as that held at Coimbatore, where agricultural officers from all parts of India (from Cashmere to Travancore, and from the North-west Frontier to Burmah) were gathered together, one cannot help thinking that in spite of the geographical proximity of Ceylon to India, there is too little community of ideas between the two agricultural departments, and that it would be to their mutual advantage to be in closer touch with one another.

The Indian department gives us the opportunity of learning what is being done by holding a Conference of Delegates every other year: and I think it right that the Ceylon department should afford the same facilities and extend the same courtesies to India.

It would be presumption on my part to suggest what we could teach India, but from what I have said under the head of Agricultural Education it is possible that India might find it worth her while to study our methods of dealing with village children.

On the other hand we would benefit vastly by interchanging ideas with such experts as the Deputy Director of Military Dairies on matters relating to cattle, the Deputy Directors of Agriculture in Madras Presidency with reference to the working of agricultural farms, and the Principal of Poona College on the subjects of education and co-operation in agriculture.

The Conference would of course be open to delegates from the Eastern tropics in general.

The arrangements at Coimbatore were well conceived and excellently carried out, and the same plan might be adopted here. Tours of inspection could be arranged for those interested in particular crops.

TROPICAL AGRICULTURE.

The great tropical planting industry, concerned with tea, rubber, coconuts, etc.—products of the first importance in the world's economy—was, strange to say, not even mentioned at the Conference, though India contributes her share in the supply of these products.

It is to be expected that an organisation of the character of the Imperial Department in India will take into account all the different phases of agriculture within the borders of the Empire, and seize every opportunity of promoting the interests of the planting industry equally with those of the indigenous agriculture of the country.

The proposal to establish a College of Tropical Agriculture in the East affords such an opportunity, and it is to be hoped that India will join hands with the rest of our British possessions in founding an institution whose aim would be to raise the standard of British tropical agriculture to the highest level of efficiency in the ever-increasing competition among the nations of the world.

C. DRIEBERG,
Secretary, C. A. S.

NEUTRALIZING THE PUNGENCY OF GINGER.

The Agent-General for Queensland in London was, at the instance of the Department of Agriculture and Stock, requested by the Chief Secretary to obtain full information relative to the methods in vogue in China for the

purpose of neutralizing the pungeney in ginger intended for use as dessert (preserved ginger). A request was also made for rhizomes for planting purposes of special varieties.

On receipt of this application from the Chief Secretary, the Colonial Secretary, Hong Kong, courteously supplied full information as follows:—

'The ginger is washed and the skin is scraped off. It is then punched with forks and washed in rice water (the water left after washing rice), to improve the colour. It is then boiled in three or four changes of refined sugar and water for one or two hours, until it is properly soaked, and then put in barrels and covered with syrup.

'In the case of dry preserved ginger, the wet ginger is strained till dry; dry sugar is placed on bamboo matting, and the ginger is rolled in it till it is coated with sugar.

'Stem ginger is the young and tender shoots on the roots. Cargo ginger is what is left after cutting off the "Stem."

'Further information on the cultivation pursued for the production of the least pungent kind of ginger is supplied by Mr. M. W. T. TUCHER, Superintendent of the Botanical and Forestry Department, Hong Kong. MR. TUCHER writes: "All Chinese ginger is less pungent than the Jamaican variety, but whether the pungency is due to cultivation or to the variety of the plant, I am unable to say.

'"The method adopted by the Chinese in cultivating this plant, I am informed, is as follows: The rhizomes are planted in the spring in ridges about 1 foot high and 2 feet apart. The rhizomes are set in ridges about 6 inches apart. Low-lying ground is generally selected, and water is kept continually between the ridges.

'"When the young shoots are from 6 inches to 1 foot above the ground, the plants are heavily manured with urine or night-soil mixed with water. This is repeated at frequent intervals.

'"About three months after planting, the first crop of ginger is ready. This is known as "young ginger," and is the least pungent and the most expensive. If the rhizomes are allowed to mature, which will be between October and December, they become more pungent, but nothing like the Jamaican."'—JOURNAL OF THE JAMAICA AGRICULTURAL SOCIETY.

IS THE EARTH DRYING UP?

To decide a question of secular variation of climate a more precise test is necessary than can be afforded by the variation of lakes or the ruin of cultivated lands or cities: for these occur in marginal regions of climate, it may be in consequence of catastrophic events such as earthquakes, or minor accidents like movements of wind-blown deposits, or even (in the two last cases at least) from political or geographical causes operating altogether outside the area concerned. A better test is best afforded by changes of vegetation of a kind not wholly destructive, such as changes which have taken place in the range of food plants or fruit trees in the countries of which we have the longest written records. Palestine furnished a very good test case of such a nature. PROFESSOR GREGORY produces a formidable array of authorities to show that no conclusions based on definite numerical statements given in scriptural writings can be maintained; and then proceeds to review the evidence obtained by SCHOUW, ARAGO, FORBES, EGINITIS and others from the distribution of the Date-palm. The Date-palm has three limits of growth which are determined by temperature; it only reaches full maturity and

produces ripe fruit of good quality at or above a mean annual temperature of 69° F. Between 69° F. and 62° F. the fruit is usually so unripe as to be inedible. Below 62° the Date-palm is grown only for its foliage ; it does not fruit. Now the mean annual isothermal line of 69° crosses the Southern Algeria near Biskra ; it touches the northern coast of Cyrenaica, near Benghazi, passes Egypt near the mouth of the Nile, and then bends northward along the coastlands of Palestine. The isotherm of 62° F. enters Europe in south-western Portugal, passes south of Nice, skirts the north-western coast of Italy to Naples, crosses Northern Greece, and enters Asia Minor in Smyrna. Hence at Benghazi the Date-palm is fertile, but produces fruit of poor quality ; at Palermo and Algiers the fruit ripens occasionally ; at Rome and at Nice the Palm is only grown as an ornamental tree. Dates grow on the coast of Palestine, and in the deep depression round the Dead Sea ; but the palm does not produce fruit on the highlands of Judæa.

In biblical times Jericho was "the city of Palm trees," and the fact that the Palm has died out since must be merely the result of neglect, for it could not have grown if the climate was moister and cooler. Engeddi, on the western shore of the Dead Sea, also had Palm trees ; and the Date-palm certainly grew on the highlands of Palestine. But there was no Date crop. Dates are not once referred to in the text of the Bible. The Palm tree is praised for its beauty and erect growth ; it is used as a symbol of victory, but not of plenty. If then the climate had been seriously different either way from what it is now Jericho would not have held the distinction of *the* city of Palm trees ; for in a hotter and drier climate Dates would have ripened on the highlands ; in a colder and moister they would not have ripened at Jericho.

The evidence of the Vine supplements that of the Date. Where the mean annual temperature is above 72° the Vine requires artificial shade and protection. In Cairo, for example, it must be kept cool and moist. Palestine lies to this day on the extreme edge of Vine-cultivation, just as it did when the twelve spies returned from Eschol with the clusters of grapes. There can have been no change of any practical importance in the climate of Palestine since the days of the Patriarchs and of the Jewish Kings.—Gardeners' Chronicle.

"FARMERS' WEEK" AT CORNELL.

It has been my good fortune to be at New York State College of Agriculture, Cornell University, Ithaca, N.Y., during "Farmers' Week." That is a great week. The ordinary work of the College is at a standstill, for buildings, apparatus, staff and students are all at the services of the visitors. They come from all parts of New York State, and from other States. For those within 150 miles of Ithaca, the Railroad Companies provide reduced rates—a cent and a half per mile. At the College every effort is made to secure the comfort of the visitors. There is an Information Bureau, where a directory of available rooming and boarding places may be seen; "checking" rooms, where coats, parcels, etc., can be left free of charge; Lunch Rooms, and even Nurseries, where young children may be tended, while the parents are in quest of knowledge. Women and men, young and old flock to Ithaca during this Farmers' Forum. Last year there were 3,000 all told in attendance. From 9 a.m. till 4 p.m. work goes on in one Department or another. An idea of the variety of the fare may be obtained from the following extract, taken from the Time-table, a printed copy of which is in every visitor's hands.

On Wednesday at 3 p.m. for example, the farmer could choose from the following list :—(a) Food Fads, (b) Mixing of Fertilizers and Calculation of

Trade Values, (c) Experiences in Building a Poultry Farm, (d) The work of the U.S. Department of Agriculture in Breeding Vegetables, (e) Fruit Packing School, (f) Cow Judging Demonstration, (g) School Conference, (h) Rural Church Conference, (i) Dairy Students' Association.

The attendances were always large, many of the halls at times being badly congested. There was the utmost enthusiasm. They were "talks" rather than lectures, and questioning was a strong feature. Here it is realised very strongly that the working farmer can teach the lecturer a good deal. It was very interesting to hear a greyheaded man give a description of his twenty-five years' experiments in the selection of Corn (Maize), though, for want of a scientific method, he had failed to "win out."

Plant Breeding or rather Plant Improvement is a science that is making considerable headway here.

One of the many conferences meeting during the week was the "New York Plant Breeders' Association." I was present at several of the meetings, when they discussed among other subjects :—"The Breeding of Corn with Special Reference to New York Conditions," "Breeding of Potatoes by Hill Selection," "Propagation of Selected Types of Apples and Peaches," "Breeding of Timothy."

Timothy is New York's chief crop, being worth about $100,000,000 annually. DR. WEBBER, who is in charge of the Plant Breeding Department, told us that they had obtained, by selection, a variety of Timothy that yielded the previous season 2,120 lb. of hay per acre more than did the ordinary seed, and was almost free from rust, while the average increase from seventeen selected varieties was 851 lb. per acre.

Other Conventions and Conferences meeting during the week were:—"The New York State Drainage Association," discussing a question that is of crying importance in much of New York State; the "Home-makers' Conference," talking over such subjects as "Household Sanitation," "Planning Meals," "Reading for Country Boys and Girls," "Insect Pests of House and Garden," "Interior Decoration," "Food Preservation," "The Housekeeper and the Cost of Living." This last was regarded as a pressing problem. The high and ever-increasing cost of living was the motif of the lecturer's address. She did not attempt to find the cause of the increase. She specified tariffs, ignorance, wastery, etc., and her talk was meant rather to suggest how a housewife, in view of the prevailing state of affairs, might economise.

It may be of interest to say here that there is a "Home Economics Department" of the College of Agriculture, where young women are trained for housekeeping.

Then there was "The Poultry Institute," whose members had demonstrations in the killing, picking and packing of poultry, grading of eggs, mixing of rations, and talks on "Breeding for Egg-production," "Lessons from large and small Poultry Farms," etc.

The "Rural Church Conference" was to me the most unfamiliar of all. The meetings of this Conference took the form of open discussions on the organisation of rural districts into socially co-operative communities. There is a "Back to the Land" problem here as well as at home. The rural problem is a very pressing one, and a feeling of its urgency ran through the whole of the week's meetings, whether held under the auspices of this special conference or not.

Until recently the population has been very mobile owing to speculation in land and movement westwards. Then there is the difficulty of the heterogeneous composition of the people. One pastor told us that he had in his church people belonging to eleven different denominations!

It struck me as unfamiliar and full of hope to hear these farmers, in the very thick of their material life, giving brotherly attention and suggestion towards the uplifting of the country people to a higher plane of life.

With these Americans, at least, the "Almighty Dollar" is *not* the greatest thing in life after all.

It is, as one speaker said, "Living" that counts.

Then there were the "School Conference," dealing especially with subjects pertaining to rural schools. We must not forget that this was not a Conference of School Teachers, as we at Home might expect, but of all country people; the "Conference of Vegetable Growers," discussing subjects of special interest to themselves.

When, and if, one wearied of "talks," he could make a round of the various exhibitions:—"Farm Stock" of the College, supplemented by animals from neighbouring breeders; "Travelling Libraries," "Corn Show," "Weather Bureau," "Entomological Exhibit," to mention but a few. The Travelling Libraries are worthy of a word or two.

New York State has a system by which small collections of books are sent from the State Library to any place in the State, the transportation charges being paid by the State. The "Libraries" are of various kinds. It may suffice to mention the "Library for General Readers," consisting of twenty-five volumes free, and as many volumes more as may be desired at a fee of 50 cents for each additional twenty-five. A person may select his own volumes or may leave the selection to the Library Department. In the State Library there are many thousands from which the selection can be made. These libraries are furnished on application from any five taxpayers and are to be kept in some central place, such as Post Office or Store. Then there are "Libraries for Study Clubs," "Libraries for Granges," "Libraries for Foreigners," etc.

The "Travelling Library" is a very prominent and commendable work of the Education Extension Division of the State Education Department.

But it was not all work!

There were Organ Recitals in the fine Sage Chapel of the University, several Musical Evenings, Lantern Entertainments and Public Speaking Contests.

I was present at one of these contests, known as the "Eastman Stage Contest." A farmer, Mr. EASTMAN, gives an annual prize of $100 to encourage the art of public speaking among the students of Agriculture, "shorthorns," as they are lovingly designated. It was the second annual contest and six aspirants for the prize took part, all taking as their subject some phase of rural life.

The prize was awarded to the speaker whose theme was:—"For a Parcels Post."

We were told that repeated attempts had been made to get the U. S. Post Office to take up a Parcels Post system, such as prevails in Europe, but without success, owing to the alleged "pull" that the various Parcels Express Companies had in high places.

We were told that whereas a parcel weighing 11 lb. could be sent from London to San Francisco for 60c, it would cost $1·76 to send a similar parcel from Ithaca, without taking into account the trouble of so wrapping it up as to conform to the ludicrous regulations.

The CHAIRMAN of the meeting, DIRECTOR BAILEY, admitted that it was a scandalous state of affairs, and remarked that a country, where such a state of affairs was possible, could not be said to be truly free.

[A Parcels Post system is now in operation.]

Well, the farmers were all present, and it was an audience such as a Cabinet Minister might have been proud to address. One of the evenings with the lantern took the form of a trip over Great Britain, visiting the Shorthorns, the Herefords, the Ayrshires, the Jerseys, the Cheviots, the Clydesdales in their native pastures.

Americans are greatly interested in the raising of stock, and are looking to a time when European buyers will come to their markets, just as at present Americans go to European markets.

Now the week is over. The scene of animation will be missed from the corridors. But these thousands of men and women will go back to their work-a-day life imbued with new ideas, stimulated and encouraged by intercourse with their fellowmen and fired with a desire to do their best for the welfare of every soul in their community.

Yet this is the Ithaca where, according to a reviewer in a prominent English Daily, "men are dreaded like wild beasts when passion besets them, and where beauty and sheer force of love can yet move them marvellously. Tess is a squatter's brat ("Tess of Ithaca' was the book under review), but her standards are high, and if she steals the common food of life she will never betray a friend or take back her pledged word. If the atmosphere of the book strikes one as unreal, it must be remembered that there are yet places in the West where climate and loneliness might produce such conditions."

How those who know Ithaca, with its far-famed University of more than 5,000 students, must have smiled!

Did the reviewer ever come to know, one wonders.

A. RUTHERFORD.

SCHOOL GARDENS.

From the Regina Horticultural Society we have received an interesting little publication on gardening.

Two of the articles in it are of particular interest, viz., "The School Garden" and "Some School Gardens of the Empire" of which we give an abstract below.

Educational progress in its fullest sense cannot come to the child from the three R's alone: these must of course be taught but to say that they are sufficient is to refuse to see progress. Too much reliance has been placed upon books and too little attention paid to the educational influence of environment.

2,500 years ago Persian boys received instruction in Gardens. In 1814 Germany took up the School Garden movement; in 1869 Austria and Sweden followed; in 1880 France. In Austria there are 8,000 School Gardens, in Sweden 2,000, and in France 2,800.

England began to recognise the value of School Gardens not much more than 20 years ago and in 1910-11 there were 2,270. The movement has spread to Australia and South Africa.

As regards Ceylon we read that the system of Schoot Gardens has attracted the attention of the officials of the International Institute with headquarters in Rome, who refer to it as the most promising and in practice the most efficient of those that had come under their consideration: and extracts are given at some length from the circulars by the Superintendent of School Gardens.

We quote below from the reports of officials in America to show the value of the School Garden in connection with the work of the school: "The work of the garden is now recognised as an integral part of the school programme, and the Garden is coming to be looked upon as the outer class-room of the school with the various plots as its black board. The Garden is not an innovation, an excrescence, an addendium or a diversion, but a happy field of expression, an organic part of the school in which boys and girls work among growing things and grow themselves in mind and body and spiritual outlook.

"There is no phase in the training given in schools which has a greater influence upon the mental, moral and physical well-being of the children and the civic and economic conditions of the country than the work of the school Garden.

"Work in school Gardens tends towards making children observant, thoughtful, careful as to details, patient and more appreciative of Nature's beauties and impressiveness, thus helping mightily in the formation of good character.

"There are difficulties but they can be overcome; there are possibilities which can be realised. The influence rather than the instruction, the interest and inspiration rather than the facts is what is desired.

"The renewed interest in School Garden is showing itself in all parts of the civilized world, because it is recognised as being of value not only to the formal studies, but also ethically."

From these and various other reports one finds ample evidence of the potential value of the movement.

MALARIA AND TROPICAL AGRICULTURE.

MALCOLM WATSON, M.D.

In studying this malaria, I found in a certain area there had been a steady rise from 1895 to 1899, and a fall from 1899 to 1902. The percentage of malaria treated at the hospital of the area had risen from 23 per cent. to 59 per cent., and then again fallen to 23 per cent. No one could account for either the rise or the fall, but a study of official reports showed that the construction of a road parallel to the sea had interfered with drainage, and that the inauguration of a drainage scheme had been followed by improvement. This seemed a reasonable explanation, and I published an account of the observation.

At this time there was considerable malaria at the Klang end of the road on the estates, and the planters complained that they could not drain their estates on account of the road. As a result of their representations, the Government voted $110,000 for the Kapar drainage scheme, which provided for the drainage of 24,000 acres. From my point of view, this was an experiment on a large scale, and I did my best to profit by it. The first thing to be done was to get exact figures as to the amount of malaria present, and I accordingly made a series of blood examinations of children on the estates. A survey of the mosquitoes of the district was also made. To cut a long story short, it was found that malaria on the low alluvial coastal land was carried by a mosquito called *Anopheles umbrosus*, which breed in pools in the jungle; and that where the jungle was felled and the pools drained by open drainage, malaria completely disappeared, as shown by the health of the coolies improving, the admissions to hospitals falling, the parasites disappearing from the blood of the children, and the percentage of children

with enlarged spleens falling from 100 to 0. It was also shown that the percentage of children with enlarged spleens (called spleen-rate) was in direct proportion to the proximity of their houses to the breeding-place of the mosquito—that is the jungle pool.

So we evolved the simple rule—that to avoid malaria on the low coast-land, we had only to house our coolies half a mile from the jungle. In some cases, we moved coolies away from the jungle; in other cases, we removed the jungle from the coolies' houses. The results were absolutuly certain. In fact, health could be guaranteed, as has been demonstrated on many estates. To show how invariably this rule worked out, I must give you two instances which at first were puzzling. An old-established estate became unhealthy: within eighteen months its labour force had fallen from 600 to about 300; the daily sick in hospital rose from two or three to seventy to a hundred—with a similar number of milder cases of fever on the estate. The spleen-rate rose from three to fifty-eight. The death-rate rose from ten to eighty. The labour force was so reduced that the rubber trees could not be tapped, and the manager was about 30,000 lb. short of the estimate. I was quite at a loss to account for the outbreak. The manager assured me none of the cooly lines (or barracks) were within half a mile of the jungle, and I could find no breeding-place near to the lines within the estate. Ultimately, I decided to walk over the whole estate, and round its boundaries. It was only then I found that the estate boundaries did not run, as I supposed, but bent so as to come close to two new lines which had been built eighteen months before.

There had been a redistribution of coolies, so that all the coolies were mixed up, and thus, at first, I was unable to locate the trouble. Needless to say, the new lines were abandoned, and within a short time improvement began, and there is every prospect of a return to health.

The spleen-rate dropped within eight months from 58 to 17 per cent. That outbreak cost the estate £10,000 sterling. In the other case, a division of an estate became healthy; the spleen-rate dropped from 50 to 5. Yet jungle remained some sixteen chains away as before. I was nonplussed at first, but said to the manager: "Something has happened to the jungle;' mosquitoes are not breeding in it." Then he remembered that that very jungle had been drained by the neighbouring estate in connection with its water supply, but the trees had been left standing.

Finally, thousands of acres have been opened on some estates with hardly a case of malaria, as the labour has always been kept at least half a mile from the jungle face being opened. Now the importance of all this is that what was always regarded as the great stronghold of malaria, collapsed almost without a struggle. The low-lying clayland, with a high subsoil water, was supposed to be the home of malaria, yet, as I have shown, we have the situation absolutely in our hands.

Again, the victory was as complete as our wildest hopes had dreamed But just as our victory had been complete in the low flat land, we were at first as completely repulsed where we least expected it—namely, in the Hill-land. We had always been taught that it was desirable to live on a hill if we wished to avoid malaria. Yet in the Federated Malay States, this is just the thing not to do in 999 cases out of a 1,000. And the reason is that malaria in the hill-land is carried by a mosquito which breeds in hill-streams, and cannot be abolished by open drainage. Its name is *Anopheles maculatus*.

When convinced this was so, we decided to put these streams under-ground for a certain distance round the habitations on the estates. The exact distance is probably about half a mile—as we found it necessary to house coolies that distance from jungle breeding-places on flat land. But in the interests of economy, I consider each estate should begin with a smaller area and work outwards. Estates were at once forthcoming with the money; Seafield, Glenmarie, and North Hummock were the pioneers.

The result was a complete success on North Hummock, where the area to be done was small ; while on the other two, there has been a distinct improvement in health, but not as complete as we wish or intend to get.

Then the Government drained an extensive area in the Federal Capital, the result of which was excellent. In the words of the Principal Medical Officer's (DR. SANSOM) Annual Report : "The results were immediate and completely satisfied the most sanguine anticipation, ... It may safely be claimed that general infection is now non-existent within the drained area." This drained area was that occupied by the highest Government officials in the land and reserved for them. No fault could be found with their houses, food of the habitants or general sanitary arrangements. Yet malaria had been an absolute scourge, sparing not even the highest. I have said enough to show that we are now on sound lines in dealing with malaria on hill land. Many details remain to be worked out, but we have already had enough success to encourage us to press on with the work.

So far, I have dealt only with dry cultivation ; now I want to turn your attention for a moment to the cultivation of rice. So long as people live in the East, rice will be required, and we cannot consider we have the victory until we can drive malaria from the rice field.

When I came to the conclusion that *A. maculatus* intended to stay in our hill streams and valleys, it occurred to me that we might drive it out by making the water unsuitable for its peculiar tastes. Ross had already suggested substituting one anopheles for another in Mauritius by starving out the harmful one. Some mosquitoes like clean water, like *A. maculatus*. Others like it muddy, and there is a series between the two. Well, I heard that rice fields were healthy, and it occurred to me that the cultivation drove out *A. maculatus*. It was of comparatively little consequence if non-malaria carrying mosquitoes existed in the rice fields. I had no prejudice against any method which promised any help against malaria. I was even prepared to make the country a swamp if so we could get rid of the disease. So I investigated rice fields, and found 66,000 acres in Krian which were healthy. Only 2·7 per cent. of 718 children had enlarged spleen. But on coming to a valley in the hills I found a high degree of infection. *A. maculatus* had been driven out, but other carriers had taken its place, so at the time I dropped this line of research.

It is, however, now being pursued by DR. SRICKLAND, the travelling Entomologist in the F. M. S., and I am confident we will win in the end We have always subsoil irrigation to fall back on.

Now I have shown that at least as regards dry cultivation we have established a working rule, if not a natural law, namely, that pool-breeding mosquitoes could be abolished by open drainage ; that stream-breeders could not be so abolished, but required sub-drainage ; that countries with no hill stream-breeders would have no hill malaria. Was this true of the world ? For, if so, it would give men a clearer idea of how the problem was to be dealt with, and offer very high hopes of ultimate success. Turning to India first, I found a strong similarity to Malaya, namely, the plains of Bengal healthy, and the Duars at the foot of the Himalayas very malarious. Now that we have got right names to our mosquitoes, we know that *A. maculatus* occurs in the Duars and in the Jeypore hills in Madras. It may not be the sole carrier, as *A. christophersi*, also a stream breeder, is a proved carrier. But the reports state that *A. maculatus* is the commonest anopheles in the upper portion of the Duars and lower hills. And in Ceylon it is also to be found.

MR. EDWARDS, of the British Museum, kindly re-examined the Ceylon collection of insects and found it was present although misnamed. Severe malaria exists in the lower hills of Ceylon. Indeed for the whole country the spleen rate is 34 on over 92,000 children examined. Again *A. maculatus* exists in Hong Kong ; so we see wherever it exists malaria is severe.

I have now shown you how the new knowledge has given us absolute control over the malaria of low flat land, and a knowledge of and high hopes of control of that in hill land. We have also every hope of abolishing malaria from rice fields. But for Ross's discovery that would have been impossible. The very greatness of the discovery has, however, had one disadvantage. It made men look at malaria from such an entirely new point of view that they forgot the old view, or certainly failed to fuse the old and the new. When men began to think of malaria in terms of the mosquito, after the first transport of delight at the discovery, they began to shake their heads and say. "How can we ever abolish all these mosquitoes?" and "This is a hopeless work." But let me take you back to the pre-Russian days. They were dark days as compared with these. Personally I would call that time the dawn, from which shot out brilliant rays in promise of day. There was no more cunningly hid secret in all nature than the malaria secret. Men searched the heavens and the earth, and the waters that covered the earth, and if they did not find it the steps by which Laveran, Golgi and Manson gradually helped to track it down are among the most brilliant in the annals of medicine. They had many difficulties. Malaria was known to be connected with swamps, and to be reduced by drainage and cultivation. Yet against that they found in some places that flooding a swamp actually improved health ; while in other places drainage and turning up the soil actually produced serious outbursts of the disease ; and yet again malaria was found not in swamps ; but in hills and dry sandy deserts. The whole subject was full of difficulties, that seemed to upset every theory. And when Ross at length proved the guilt of the mosquito, it was such a long step forward that when men looked round, they did not recognise the old landmarks.

It is to these old landmarks no less than to the new light that we must look if we would succeed. These old observations about swamps and drainage did not apply to towns. They applied to rural malaria. Our forefathers knew malaria did disappear at times from wide rural areas, sometimes by the drying of the land, sometimes by flooding it.

It had been proved hundreds of times—and indeed was the most outstanding feature in our knowledge of malaria. To-day I have merely shown you instances from different parts of the globe of what was well known to our fathers. There is nothing really new except that now we are able to understand better how the change takes place. It is because we have in the mosquito the key to the process of improvement, that I have high hopes for the future. I believe that the prevention of malaria, the improvement in health of the agriculturist, and the cultivation of the land are all intimately connected, and that what improves the one will improve the other. But, and this is my last word, before money is spent on agriculture in the name of malaria prevention, the spending authority should insist on the medical officer showing sound practical reasons for the advice he has given. Such reasons should be based on a study, not only of the malaria-stricken parts of the country, but also of the unhealthy portions, for it is in the latter the secret is hidden which will bring health to the whole land.—United Empire.

PROF. DUNSTAN, F.R.S.

At a Meeting of the Board of Agriculture held on the 3rd February.

The Board extended a hearty welcome to Prof. Wyndham Dunstan, Director of the Imperial Institute in London (with which the Society has been in close touch since its inception), who is on a visit to Ceylon. The Institute is concerned with the technical examination of new products from the British dominions, and is ready to furnish reports from data based upon scientific investigation. It is therefore of the greatest assistance in developing the resources—agricultural and mineral—of the British possessions.

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Ceylon Agricultural Society.

Memorandum by the Secretary.

Members are particularly requested to NOTIFY CHANGE OF ADDRESS, and also forward necessary instructions when leaving the Island, temporarily or permanently. Members who fail to NOTIFY THEIR INTENTION TO RESIGN from the Society will be held liable for subscription till such notification is received

ENROLMENT of new members can take place at any time; but, the subscription being annual, no reduction on the rate can be made. Members joining later than January will be entitled to receive back copies of the "T. A." and other publications.

Full sets of "The Tropical Agriculturist" for 1906, 1907, 1908, 1909, 1910 1911 & 1912, can be supplied to members on application.

Those wishing to join the Society can do so by filling up and forwarding appended form with a year's subscription—(Rs. 8 local; Rs. 15 foreign) to

THE SECRETARY, CEYLON AGRICULTURAL SOCIETY,
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to whom remittances must in all cases be made payable.

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MALAYAN AGRICULTURE IN 1912.

COCONUTS.

The following extracts are from the Annual Report of Mr. L. Lewton-Brain, Director of Agriculture, F. M. S :—

It will be noted that the main increases in the areas under coconut cultivation are in the Coast districts of Lower Perak, Kuala Selangor and Kuala Langat. In all these the soil is flat and of a rich alluvial nature, and the chief difference between one estate and another lie in the possibilities as regards drainage and extent of the upper layer of organic matter, the so-called "peat." In some cases this is several feet in thickness, while in others it is practically non-existent; where this land can be properly drained the growth on it of the coconut is excellent.

A good deal of coffee is grown as a catch crop among coconuts, both the Liberian and Robusta varieties being used for this purpose. There is very little objection to this practice and the coffee can be relied upon to yield revenue for many more years than it will under rubber. I have seen this combined cultivation give excellent results especially in the Kuala Langat district, and have been unable to discover any ill-effects on the coconuts.

Leguminous and other cover crops are also extensively grown among coconuts, and when they are carefully attended to they serve to reduce, though certainly not replace, expenditure on weeding.

In native holdings, of course, coconuts are very generally grown interplanted with fruit trees and where the holding is properly looked after there is apparently very little ill-effect.

FERTILIZATION IN PADDY.

About 50 varieties were grown in pots artificially irrigated and some 200 attempts at cross fertilization were made. Of these only about 6 per cent. showed any swelling of the ovary and only six of the resulting seeds germinated, producing seedlings which never reached maturity. This result is very disappointing and attempts were made to ascertain the cause of it.

Some flowers were opened by merely separating the glumes at the top, others by cutting away the tip of the glume with a pair of sharp scissors. In these cases great care was taken so as not to disturb the reproductive organs and none of the flowers were emasculated. Thus these flowers were given every chance of effecting normal self-fertilization, but in no instance was a fertile seed produced. A partial swelling of the ovary took place and a shrunken grain was produced in some cases, but the fertility of these seeds was much the same as those produced by cross fertilization.

It was therefore concluded that the mechanical operation of opening the glumes to effect cross fertilization interfered with the development of the seed. It is possible that this mechanical difficulty may be overcome in the better equipped culture house which is approved for 1913, than the one in which these experiments were conducted.

It has been found in Java that natural cross fertilization is fairly common and that crosses can be effected by tying two ears together during the flower-period. Though this method does not exclude the probability of self-fertilization, quite as good results can be obtained from it with proper care in the selection of seedlings.

ENSILAGE.

SAM. HIGGINBOTHAM.

DEFINITION OF SILO.

A silo may be briefly described as a structure having air-tight and moisture-proof walls, in which a forage crop is stored and preserved indefinitely. Enlarging upon the definition we may say that a silo should be conveniently arranged for filling and emptying, should have a perfectly smooth inside surface, allowing the silage to settle compactly, should be of non-heat conducting material, and should be strong enough to withstand a bursting pressure of several hundred pounds per square foot.

SHAPE OF SILO

Experience has shown that the round silo is the best. A silo is really constructed according to the same principle as a fruit or jam jar or tin. As long as it remains air-tight the contents remain good. As soon as air gets in they go bad and decay.

MATERIALS FOR MAKING SILO.

It may be made of wood, brick, cement or glazed tile. It may be below ground. It may be above ground; for Indian conditions a hole in the ground, very much like a well cylinder, is possible and especially if the sides can be lined with well bricks and then smoothed off with either lime or *gobar* plaster. Where money is plentiful the above ground silo is better.

SIZE OF SILO

The silo should not be less than ten feet in diameter and not less than sixteen feet deep. How deep under ground a silo may go depends upon the depth of the water table, as it will not do to have the material standing in water. For ease of getting out the silage a circular path may be left eighteen inches or two feet wide by which coolies can go up and down to get the stuff out.

DEPTH OF SILO.

The deeper the silo the better, as greater pressure is exerted and the silage more compressed. That is, one silo 32 feet deep will hold more silage than two or 16 feet deep and the silage from the 32 feet silo will be of better quality than from the two. The size of the silo can be determined by the number of cattle to be fed from it. If a large number, say, over a hundred cattle are to be fed, the diameter should not be less than twenty feet. If from fifty to a hundred, from 16 to 20 feet diameter is sufficient, from ten to fifty cattle, 10-16 feet diameter. For less than ten cattle a silo would hardly pay. Therefore in most Indian villages the silo must be a community affair. This is one place where co-operation has a splendid field.

WHAT SHOULD DETERMINE SIZE OF SILO.

The size of silo needed depends upon the number and kind of stock being fed and the feeding standards adopted. It is safe to figure for large cattle like the Hissar 30 pounds per day, for small cattle 20 pounds per day, horses and mules 15 pounds per day, sheep and goats 4 pounds per day. Then the question arises as to whether grazing will be available or not for part of the year. If it is not, then the cattle must have enough for 365 days per year. Multiply the quantity of silage each animal will require per day by the number of head to be fed. This will give the total amount required each day by each kind of stock. Do this with the different kinds of stock and you get the total amount fed to all animals of every kind per day. Then multiply this by the days in the year and divide by 2,240, the number of pounds in one ton. You will know then how much is required per year.

Example :—

	Number of Stock.	Pounds of Silage per Animal per day.	Total of pounds of Silage for each kind of stock per day.	Total pounds of Silage for each kind per year.
Dairy Cows	...20	... 30	... 600	... 219,000
Work Oxen	...30	... 30	... 900	... 328,500
Sheep and Goats	50	... 4	... 200	... 73,000
Horses	...10	... 15	... 150	... 54,750
Total pounds eaten by all stock in one year				...675,240

Divide by 2,240 and we get 301. 5 tons of silage.

DIMENSIONS OF SILO.

We are now ready to calculate the dimensions of the silo required. Numerous factors affect the density of the silage in the silo. But for ordinary juar or maize put in at the milk stage of the grain, well compacted and sufficiently moist, the following table has been found by experience to be not far out. The nearer the bottom of the silo the denser the silage because the greater the pressure, other things being equal :—

Diameter Feet:	Height Feet.	Estimated Capacity Tons.	Approximate Number of Acres required to grow this amount.*
10 ...	20 ...	30 ...	3
10 ...	24 ...	36 ...	4
12 ...	20 ...	45 ...	4
12 ...	24 ...	55 ...	5
12 ...	26 ...	60 ...	6
12 ...	30 ...	70 ...	7
14 ...	20 ...	60 ...	6
14 ...	24 ...	73 ...	7
14 ...	26 ...	80 ...	8
14 ...	28 ...	90 ...	9
14 ...	30 ...	100 ...	10
16 ...	30 ...	120 ...	12
16 ...	32 ...	130 ...	13
18 ...	30 ...	150 ...	15
18 ...	34 ...	175 ...	18
20 ...	20 ...	185 ...	19
20 ...	32 ...	200 ...	20
25 ...	30 ...	275 ...	28
25 ...	32 ...	300 ...	30

DEFINITION OF SILAGE.

Silage or ensilage is any succulent forage crop preserved in a silo. It is fodder preserved in a moist, palatable state which can be used as a green feed all the year.

CROPS SUITABLE FOR SILAGE.

Various crops are used for this purpose, but maize, juar and bajra are the best because of the sugar in their stalks, the large amount of nutriment contained and the tonnage per acre. Almost any cultivated or jungle grass, oats, barley, wheat, peas, lucerne, crushed sugar-cane, sugar-cane tops, weeds such as thistles, that otherwise cattle will not eat, can be converted in the silo into nutritious food.

SUPERIORITY OF SILAGE.

Silage, compared with pasturage, easily shows the inferiority of the latter, the milk and energy production falling off when silage food is discontinued and the stock is turned out on grass pasture.

* Average yield per acre taken as ten tons of juar or maize.

The best time to put fodder into the silo is just before maturity or when the grain is in the milk stage. In case, however, it is desired to take the grain crop, then just as soon as the grain is gathered, the stalks should be put in the silo, water being added to thoroughly moisten the whole mass. In case the grass of fodder crop is not near the maturity stage then the silage will be more acid, a plant at the milk stage of the grain has been found by experience to provide the most palatable and nutritious silage. The fodder to be put in the silo should be put in as soon after cutting as possible and as clean as possible. The silo is not a fairy chemist that can turn mouldy, dirty fodder, into clean, appetizing succulent food.

FILLING THE SILO.

The silo should be filled as soon as possible after the fodder is carried from the field. This to prevent mould. (Mouldy silage is not as palatable as the other and while cattle do not seem to suffer from it, it is often fatal to horses.)

The fodder should be cut, the finer the better, depending upon the kind of crop put in and the stage of growth, suitable lengths are $\frac{1}{2}$ in., $\frac{3}{4}$ in., and one inch. Unless it is cut fine it does not pack down well, and if it is put in uncut it is impossible to get it out without loosening a lot more than is taken out, and after it is loosened and exposed to the air it will soon mould and give off a very bad odour and cattle will not as readily eat it.

After the fodder is cut fine then it should be thrown into the silo and well tramped all the time it is being put in, and if it is at all dry, water should be added. After the day's filling, and it has stood overnight, even when it has been well tramped, it will sink a lot and it is a wise practice to tramp it well first thing in the morning before new material is thrown on to it. The silo should be a week or ten days in filling in order to get the best packing results.

When the silo is full it may have the upper foot sprinkled with salt, two to three maunds being used, or it may be covered with dry earth well rammed, or it may be covered with a roof or left uncovered. Under any system of storage the upper few inches go bad and form a crust which protects that below. It will get hot, about 160° F., and partially cook.

It may be fed from the time it is put in.

SILAGE CUTTERS.

The fodder may be cut by a silage cutter, a machine specially designed for the work. The mission farm uses the "Smalley" which cuts about three maunds per minute. A convenient size takes about ten horse power. In a village a hand machine may be used. (I have asked several manufacturers to make a machine that two or four oxen could work.) Or the ordinary chopper, with this latter practically all the village would have to work at it to get the pit filled in a reasonable time.

Silage if properly put into a correctly constructed silo will keep indefinitely. I have seen it fed in India after being kept in earthen pits for three years and the cattle ate it with relish.

After a silo is opened two to three inches per day should be raked off the top, as evenly as possible. If it is not taken off every day the exposed portion is likely to mould. If it is dug out in places, this causes an exposure to air and mouldy silage will result.—JOURNAL OF DAIRYING.

N.B.—The size found most suitable on Government Military Dairy Farms is 20 ft. dia. 30 ft. high.

THIRD INTERNATIONAL CONGRESS OF TROPICAL AGRICULTURE, LONDON, 1914.

The International Association for Tropical Agriculture (Association Scientifique Internationale d' Agronomie Coloniale et Tropical) has decided to hold in London, in June, 1914, an International Congress, in which all countries interested in Tropical Agriculture and Forestry are invited to participate.

The Congress will be held at the Imperial Institute, South Kensington London, S. W. It will open on Tuesday, June 30th, 1914.

In the order of business at the Meeting, the morning sittings (10 a.m. to 1 p.m.) will be reserved for papers and discussions on subjects of general importance, each morning being devoted to a single subject; the afternoon sitting (3 to 5 p.m.) will be reserved for papers and discussions on special subjects. The following subjects are suggested for papers and discussions at the morning meetings. Contributions on these and similar subjects are invited:—

I. Technical Education and Research in Tropical Agriculture.

II. Labour Organisation and Supply in Tropical Countries.

III. Scientific Problems of Rubber Production.

IV. Methods of Developing Cotton Cultivation in New Countries

V. Problems or Fibre Production.

VI. Agricultural Credit Banks.

VII. Agriculture in Arid Regions.

VIII. Problems in Tropical Hygiene and Preventive medicine.

Papers for the afternoon meetings are invited on the following subjects:—

I. Problems relating to Tropical Agriculture and Forestry.

II. The Cultivation and Production of:—

Rubber.	Tea.
Cotton and Fibres.	Coconuts.
Cereals and other Fooodstuffs.	Other Agricultural Products.
Tobacco.	Forest Products.

III. Plant Diseases and Pests affecting Tropical Agriculture.

Papers recommended for publication and Reports and Discussions will be published at the close of the Congress.

The subscription for membership of the Congress will be £1, entitling members to admission to all meetings and receptions and to receive the volume of printed papers and discussions, on publication.

A General Programme, with the complete arrangements, will be forwarded to all registered members before the Meeting.

Arrangements will be made for the accommodation of members of the Congress at suitable hotels.

Arrangements have been made by the Organisers of the International Rubber Exhibition and of the International Cotton, Fibres, and Allied

Industries Exhibition to hold these Exhibitions during the period of the Congress, at the Royal Agricultural Hall, Islington, London, N. Members of the Congress will receive free season ticket of admission to the Exhibitions; and special means of conveyance between the Imperial Institute and the Agricultural Hall will be provided.

The Organising Committee cordially invite all who take an interest in Tropical Agriculture and Forestry to attend the Congress and to make the contents of the present circular as widely known as possible.

All correspondence relating to the communication of papers and the arrangements for the Congress should be addressed to:—

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SERICULTURE EXPERIMENTS IN THE PUNJAB.

Mr. W. S. Hamilton, I.C.S., Director of Agriculture and Industries in the Punjab, in his Report for 1912–13, says :—Sericulture cannot spread much in the Punjab outside the submontane districts ; for elsewhere the season between the opening of the leaves on the mulberries and the setting in of the hot April winds is too short. We have this year taken a good step forward. Gurdaspur is the only district in which sericulture is established. The seed for that district is distributed by Khan Bahadur Shaikh Ghulam Sadik, who takes a lease of all the District Board mulberry trees. Last year the amount distributed was 399 oz. and the yield was only 47 maunds of dry cocoons. Seventy kilogrammes (77 seers) of green cocoons, equivalent to about 25 seers of dry cocoons, is the outturn in France of 1 oz. of seed. So with very moderate care on the rearers' part the yield in Gurdaspur should have been at least 120 maunds. The bad results are due to the rearers' inveterate adherence to dirty methods and under-feeding. They will not listen to advice and even the loan of racks which I tried this year in one village did not result in the racks being used. I fear we shall not be able to convert the rearers in this district to better methods.

The advance made this year is that outside the Gurdaspur district we have had the rearings carried out by villagers in their own homes instead of by canal officers, where rearings did not really achieve the object aimed at, namely, a demonstration open to the surrounding villages. The arrangement this year has been that we selected rearers in villages near mulberry plantations and the canal department issued passes to the rearers for the collection of leaves; 44½ oz. of seed (out of a total of 51 oz. issued) yielded nearly eight maunds of dry cocoons. Considering that most of the rearers had never before seen a silk worm, the results were fairly satisfactory—surprisingly so in the Rupar and Kasur tahsils. We shall be able to issue about 150 oz. next year.

The Salvation Army reared 12 ounces of seed in the serai at Changa Manga, where they have a settlement of criminal tribes. The mulberry leaves are obtained from the enormous mulberry forest close by. The outturn was just three maunds of dry cocoons.

Commissioner Booth-Tucker ascribes the failure to obtain better results to (1) irregular and prolonged hatching ; (2) over-crowding in the last stage. Over-crowding and the difficulty of collecting sufficient leaves in the last stage will always be felt when rearings are centralised.

I held an exhibition of cocoons at Gurdaspur in the last week of May and distributed a good deal of money in prizes. This is a revival of a practice which was in force for many years when silk rearing was carried on at Madhopur. The exhibition will be annual. It is unfortunate that it must be held almost at the hottest season of the year. There is also no building in Gurdaspur which will house the bulky exhibits.

Acting on a suggestion of Commissioner Booth-Tucker of the Salvation Army, I am arranging for small rearing next spring by boys in primary schools, near which there are mulberry trees. I am sure sericulture promises to the poorer peasants an easy and almost certain way of earning Rs. 30 or 40 by six weeks' work. For complete success we must secure earlier and evener hatchings. Next season we shall try hatching out all the seed of a village in a castelet, so as to get evener results. For earlier hatching we must have a small plantation of bush mulberry in every village in which sericulture is taken up. I have tried this year to get such plantations started through the Deputy Commissioners in the shamilat of some villages, but I do not think much has been done. With a little more persuasion something may be achieved.

I have asked the Deputy Commissioners of submontane districts to supply me with maps showing in what villages there are 20 or more mulberry trees. We shall distribute seed according to these maps and shall advise the maintenance and replacement of the mulberries in those places where sericulture is really taken up.—Indian Trade Journal.

CAMPHOR PRODUCTION IN INDIA

R. S. PEARSON, I.F.S.

There are two principal camphor trees of India—*Cinnamomum camphora* and *Blumea balsamifera*. Cinnamomum camphora occurs along the Eastern side of Asia from Cochin China to Shanghai, and in the islands from Hainnan to South Japan. Its limits of latitudinal range are from 10° to 34° N., but it is cultivated in Japan to 36° N. In countries south of these latitudes the tree occurs chiefly in the hills at moderate elevations. The principal source of these trees is of course Formosa where the Japanese Government have held the monopoly since 1898, but camphor trees are common over most of the Eastern Provinces of China : Kawangtung, Fokein, Chikiang, Hunan, Kiangsu, and Kiangsi. The trees, however, are more isolated than in Formosa and the supplies are therefore more precarious, due to the difficulty in exploitation. The tree is not indigenous to India but has been successfully planted in Burma, Ceylon and the Federated Malay States.

In Burma there are plantations in the upper Chindwin, Myitkyina, Bhama and Southern Shan States. In the Peninsula of India there are experimental plantations in the Nilgiri Hills and in certain isolated patches of Bombay and Madras. In Ceylon, which lies south of the latitude of its habitat, the tree grows only in the more elevated parts : there is a plantation at Hakgala. Great difficulty has always been experienced in getting good seed imported direct from Japan, and there is often wholesale failure to germinate. Seeds can be obtained from the Yokohama Nursery Company, but the seeds sown for the Burma plantations were obtained from Hongkong.

It is important to remember that the seeds should be fresh as they are liable to deteriorate, that they should be sown in well dug nurseries and require a moist light soil. Germination is facilitated by soaking the seeds in slightly lukewarm water for 24 hours.

Propagation by layers is also successful but slow, and it has been found in Hakgala that propagation by root cuttings is far more successful.

In Ceylon it has been found more economical to grow the trees in hedges of about 6 to 9 feet high running in the direction of the prevailing winds.

As soon as the plants have reached a fair size and formed woody stems below, they can be clipped—in 3 years' time in suitable situations. The simplest method is to use hedge shears. Only the leaves and twigs are required, as the use of the wood and roots only leads to wanton destruction of the plants as is the case in Japan and Formosa.

The working percentage of camphor obtainable varies, but would be about 1·2 to 1·4 of the air dry weight of the leaves which yield more than the twigs and woody tissues. Exposure to the sun or moisture diminishes the percentage of camphor.

Blumea balsamifera is an evergreen semi-shrub indigenous to Eastern India, especially the Shan States of Burma. It also grows in the Islands of Hainan and Formosa and South China. The camphor extracted in a primitive method from this shrub is exported from the port of Hoikow in Hainan : about 15,000 lb. is exported annually.

The method of camphor extraction is similar to that employed for the extraction of camphor from *Cinnamomum camphora*. The Chinese, however, use a much more primitive method still. The leaves are placed in a wicker basket which is fixed over an iron cauldron containing water. On the top of the basket a basin of cold water is placed. The steam from the cauldron passes through the leaves of the basket and carries over the camphor vapour which is deposited in the form of camphor on the cool under-surface of the basin. The camphor is refined in a way similar to that described in the INDIAN TRADE JOURNAL of the 31st October, 1907.

Of the other camphors the Barus camphor for medicinal purposes is the most important. It derives its name from Barus, a town in Sumatra. The tree *Dryobalanops camphora* grows in Borneo and Sumatra and the camphor is known in India as Bhimasani or Baras. It is somewhat similar in odour to ordinary camphor but is less pungent.

The comparative commercial value of the three kinds of camphor stated above shows that the ordinary *Cinnamomum camphora* camphor is by far the commonest and cheapest. The Nagai camphor from *Blumea balsamifera* which contains a much smaller percentage of volatile oil is much rarer and is about 10 times the price of the former. Samples of this camphor sent to Europe for valuation from here were not reported favourably on.

The Barus camphor is prized solely on its medicinal properties and is valued at 100 times the value of *Cinnamomum camphora*.—INDIAN TRADE JOURNAL.

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DATE PALM SCALES.

In the Journal of Economic Entomology, of October 1913, R. H. Forbes, Director, Arizona Experiment Station, has an article on "The Gasoline Torch Treatment of Date Palm Scales." He writes :—

"Date palms imported from the Old World into Arizona during the past 23 years have been found generally infested with two scale insects, *Parlatoria blanchardi* and *Phœnicococcus marlatti* commonly known as the Parlatoria and the Marlatt scales.

These two scales are very highly specialised in their food habits subsisting so far as yet known only upon the date palm.

(Newstead in Bull. Ent. Research Vol. II Pt. 2nd July 1911 P. 992 refers to *P. Blanchardi* Targ. as occurring on Mis-mish (Apricot). He says the examples are not quite typical, but speaks as if *P. Blanchardi* occurred on various food plants.)

P. Blanchardi infests the outer parts of the tree including leaf stalks, foliage and fruit. *Phœnicococcus marlatti* however, shuns exposed situations and is found deeply buried between the overlapping bases of the leaf stalks, only rarely appearing where the insects may be seen without digging into the tree. Occasionally, also, the Marlatt scale may be found upon partially exposed date palm roots.

In devising a method for the extermination of *Parlatoria blanchardi* several years ago the writer, guided by his observation of the Mexican practice of burning date palms to clear them of dead foliage, drenched the trunks of a number of palms with gasoline and set fire to them.

The gasoline blast torch was afterwards found to be much more effective, penetrating inward and downward into the spaces between the leaf bases and thus reaching and exterminating the Parlatoria scale.

This method has been in use in the Salt River Valley for the last eight years and this treatment, combined with judicious pruning of the older foliage of infested palms, has been found to accomplish the control of *Parlatoria* thoroughly and economically.

The Marlatt scale, however, by reason of its deep-seated location in the date palm is not reached and exterminated by a treatment which suffices for *Parlatoria*. However, by cutting the old leaf stubs of the palm clean down to the bole of the tree, thus largely removing infestations of the Marlatt scale, and by then thoroughly burning the exposed bole of the tree with the gasoline torch, this scale may be entirely removed.

The old Egyptian palms on the Experiment Station Farm near Phœnix, Arizona, thus thoroughly pruned down to the boles and burned in 1906 are found at this time (1913) to be entirely free from Parlatoria and Marlatt scales. On the basis of these observations the following treatment of infested date palms is recommended, and has been adopted by the Arizona Commission of Agriculture and Horticulture : Destroy *Parlatoria blanchardi* on infested date palms and their attacked suckers by pruning and burning with the gasoline blast torch as described in Bulletin 56 of the Arizona Agricultural Experiment Station. A year after such treatment, if the tree appears to have been successfully treated, as has proved the case with 90 per cent. of those burned in Arizona, the suckers may be cut and transplanted, still infested, however, with Marlatt scale.

When the old tree has ceased bearing suckers it becomes practicable to clean the bole and burn it more thoroughly to eradicate Marlatt scale, the tree or orchard of trees being thus finally freed from both infestations.

Transplanted suckers, which at the time of cutting could not have borne the severe burning necessary to deprive them of Marlatt scale, can be followed up in the same way and finally freed of infestation."

[NEWSTEAD (loc. cit) speaking of *Sphærococcus marlatti Cock=Phœnicoccus marlatti Cock.*, which is probably the same as *Phœnicococcus marlatti Cock.*, states, on the authority of DRAPER, that "the pest can be destroyed by painting with strong kerosene emulsion which should reach all infested parts.]

A. RUTHERFORD.

AGRICULTURAL SOCIETY'S WORK ON PADDY.

MR. MOLEGODE, A.I., assisted by MR. NUGAWELA, A.I., are conducting interesting spacing experiments at Watuwela and Nugawela. These 4 plots are planted up with (1) single seedlings 3 in. apart, (2) 2 seedlings 3 in. apart, (3) 3 seedlings 6 in. apart, (4) 4 seedlings 6 in. apart.

MR. BANDARANAYAKE, A.I., has furnished the following details of a trial made in Uva: site Uduwara, extent $\frac{1}{8}$ acre, seed paddy $7\frac{1}{2}$ measures, variety Ratkunda, age 4 months, age at transplanting $3\frac{1}{2}$ weeks, yield 9 bushels; calculated yield per acre 72 bushels.

The Secretary has a field of two acres cultivated with selected Hatiel (DR. LOCK'S) paddy—$\frac{1}{3}$ without manure, $\frac{1}{3}$ with bone meal, $\frac{1}{3}$ manured with a complete fertilizer. Results will be available next March.

The Secretary inspected fields sown with the above variety about Peradeniya and found the growth very satisfactory and better than that of ordinary Hatiel. MESSRS. MOLEGODE and NUGAWELA will be deputed to select seed from the standing crop for subsequent sowing.

MR. MOLEGODE is also conducting a trial in thin sowing. A field ordinarily sown with a pela (10 lakhs) has been sown with half that quantity.

The field in Matale town, kindly placed at the disposal of the Society by the Assistant Government Agent, is carrying a *maha* crop after growing a green manure crop last *yala*.

The Secretary contributed two papers on the question of improving paddy cultivation which was brought before the Committee of Agricultural Experiments by MR. A. W. BEVEN. The result of the discussion is expected to lead to the adoption of practical measures, the chief of which is to establish a demonstration paddy field in each district.

MR. N. M. JAYASURIYA, Agricultural Instructor, Galle, reports that by the application of the following manure mixture supplied by MESSRS. FREUDENBERG & CO., viz.:—

Cwt. 6 Steamed Bones
" 21 gr. Best castor cakes
" 13 gr. Sulphate of Potash

the yield of the area (3 acres) was doubled and the people of Hakmana where the experiment was tried are much struck by the results.

MOVEMENTS OF C.A.S. STAFF.

The Organising Vice-President visited the following places in the course of his tours :—Teldeniya, Chilaw, Anuradhapura, Kalutara, Negombo and Henaratgoda.

The Secretary's circuits took him to Hindagala, Teldeniya, Kobbekaduwa, We-uda, Pilessa, Wariapola, Nikeweratiya, Anamaduwa, Tonigala, Kurunegala, Awalagama, Munnekulama, Colombo, Nugawela, Kegalla, Kadugannawa, Pindeniya and Mawanella. The Secretary also spent ten days in India whither he proceeded to attend the Agricultural Conference at Coimbatore held in December, 8-13.

The following changes took place at the beginning of the year :—Mr. L. de Z. Jayatilleke from Colombo to Galle ; Mr. M. J. A. Karunanayake from Galle to Colombo ; Mr. C. H. de Saram, Puttalam and Kurunegala circuits ; Mr. A. Madanayake from Kurunegala to Anuradhapura. Mr. D. V. S. Gunawardene from Hambantota to Experiment Station, Peradeniya (to complete his training). The following officers continue at their former stations :—Mr. S. Chelliah at Jaffna ; Mr. Walter Molegode at the head office, Peradeniya ; Mr. J. R. Nugawela at Kandy ; Mr. N. M. Jayasuriya in Hambantota district ; Mr. Bandaranayake at Badulla ; Mr. L. A. D. Silva at Ratnapura ; Mr. Chinnaswamy Pillai at Batticaloa.

The distances travelled by the Instructors during the period covered by this report are as follows :—

Mr. Molegode, 425 miles ; Mr. Chelliah, 232 ; Mr. Silva, 70 ; Mr. Jayasuriya, 65 ; Mr. Karunanayake, 120 ; Mr. Madanayake, 161 ; Mr. Bandaranayake, 88 ; Mr. Nugawala, 304 ; Mr. de Saram, 81 ; Mr. Jayatilleke, 44 ; Mr. Gunawardene, 40 ; Mr. Pillai, 199. The mileage above indicated does not include distance covered by train or public conveyances.

PAPAIN IN CEYLON.

The Principal Collector of Customs has kindly furnished the following figures relating to the export of Papain from Ceylon during the three years 1911, 1912 and 1913. This will give an idea of the local output of papain and the countries to which it goes :—

Countries to which exported	1911		1912		1913	
	Quantity	Value	Quantity	Value	Quantity	Value
	lbs.	Rs.	lbs.	Rs.	lbs.	Rs.
United Kingdom	4,054	20,320	9,088	34,332	12,705	44,183
Foreign Countries..						
Belgium	—	—	76	229	376	1,881
Germany	2,007	11,401	1,708	7,159	2,555	12,705
United States of America	550	2,500	2,048	8.948	2,912	13,078
Total...	6,611	34,211	13,920	50,668	18,548	71,847

RATE OF C.A.S. SUBSCRIPTION.

Following upon the notification made under this head in the last issue of the Journal, subscribers are informed that the question of raising the rate was duly brought up for discussion at the last meeting of the Board held February 3rd, 1914, and with the approval of all present the local rate was fixed at Rs.10/ and the foreign rate Rs.15/ (£1) per annum.

In return for the increase in the local rate it has been decided to issue free to members a revised and enlarged edition of the Year-Book, to add a Folio to the Journal from time to time, and to arrange for the contribution of original articles by members of the staff of the Department of Agriculture.

In view, however, of the fact that no notice could have been given before the beginning of the current year of the intention to increase the rate and that a number of subscriptions have already been received in advance for this year, it has been decided to adopt the new scale of charges from the beginning of next year by which time it is hoped to have the new Year-book ready for issue.

Subscribers will therefore please take note that the new rate will come into force after the end of the current year, and make their remittances accordingly.

C. DRIEBERG,
Secretary, C. A. S.

Peradeniya, 10th February, 1914.

RECENT INTRODUCTIONS BY THE AGRICULTURAL SOCIETY.

Cassia Beareana seeds obtained through MR. DAVID FAIRCHILD, Agricultural Explorer, U.S.A. (referred to in Progress Report XLIII) have come up well. In a letter received subsequently MR. FAIRCHILD reports that the Acting Botanist at Amani has discovered that to meet the demand, seed of *Cassia fistula* (*Sin.* Ehela) are being passed off as the true article.

The Secretary C. A. S. brought with him on his return from Coimbatore a small quantity of spelt wheat which he found to be doing well there. The seed was planted in four localities under different conditions of elevation and rainfall and has come up well.

BETEL VINE DISEASE.

The Government Mycologist reported as follows on diseased betel leaves from Urugala School Garden : "Your specimens are attacked by the common betel leaf disease. The fungus is an *oidium*, one of the true mildews." With a view to test the efficacy of spraying with Bordeaux Mixture, MR. MOLEGODE, Agricultural Instructor, visited the garden with mixture and sprayer and instructed the teacher as to the method of treating the vines. The results have been entirely satisfactory.

In Southern India, where betel leaf disease is practically unknown, the vines are trained on *Sesbania grandiflora* (*Sin.*, Katurumurunga) : while here they grow upon dead sticks. Arrangements have been made for growing betel on live *Sesbanias* in selected School Gardens.

CO-OPERATIVE CREDIT SOCIETIES.

The progress made in the formation of these Societies of which so much is expected when they are in full working order, is most satisfactory. The Secretary to the Board of Control who kindly supplied a list of registered Societies given below reports that specimen bye-laws and forms are now available and may be had on application to him at Peradeniya. The localities in which Societies have been established are: Wellaboda Pattu; Hinidum Pattu; Weligam Korale; Galboda & Kinigoda; Puttalam; Akmimana; Galle Gangaboda Pattu; Magam Pattu; Haris Pattu; Nanaddan West; Nanaddan East; Mantai South; Tellippalai; Henaratgoda; Uva; Three Korales; Walapane; Copay; Mantai North; Talpe Pattu; Tamankaduwa; Kandaboda Pattu; Handapangoda, Batticaloa District; Tampiluvil; Hiriyala Hat Pattu; Udahewaheta; Galagedara; Uduppiddi Parish; Medagama; Makulla; Kadawata Korale.

This result must be very gratifying to the Director of Agriculture who is Registrar of Co-operative Credit Societies.

MEMBERSHIP OF C.A.S.

The following new members joined since the last meeting held on 3rd November, 1913:—

J. S. W. De Soysa; Chas. L. Macleod; C. Canagasabai; Lal Rama Chandra Gupta, D. M. Weigel; W. Bryce; A. Mockford; The Manager, Amherst Rubber Estates Ltd.; D. H. P. Abeywardene; P. C. Fernando; F. Farley; N. Nicollier; The Manager, Sengon Rubber Estates; F. N. Ch. Durege; L. Dohme; Deputy Director of Agriculture, Burma; T. J. Hollander; P. Krishnaswamy Rao; Dr. L. D. Parsons; Dr. H. M. Peris; C. M. De Soysa; Nogaku-Kyoshitsu; The Kagoshima Kota Norin Gakke; Zuishum Hashiramoto; The English & Scottish Co-operative Wholesale Societies, Colombo; C. Jinadasa; M. Namasivayam, Dr. J. L. Obeysekere; Ronald A. Senior-White; N. D. S. Silva; Besoekisch Proefstation, Djember; Caoutchoucbedrijf By het Boschwezen at Buitenzorg; Lieut. Col. M. W. Douglas, C I.E.; N. Hagen; T. Hirai; The General Manager, Mount Austin Rubber Estate; Tokyofu-Engei-Gakko; Oscar Zuloaga; B. R. Babapulle; W. R. Simpson Ladell; J. T. Peffers; O. F. Payne; F. W. S. Felsinger.

The total number of members at date is 1822—907 local and 915 foreign members.

CEDAR WOODS.

MR. W. DALLIMORE in the Kew Bulletin No. 6 of 1913 writes about Cedar wood, so called owing to some resemblance to the real cedar. Among the trees mentioned are some familiar enough to us, viz., *Cedrela Toona*, common on up-country estates as a shade and fuel tree—an introduction from Australia. In India the wood is used for tea and cigar boxes. *Melia azadarch*,, the Persian Lilac or Indian bead tree of our gardens. It may be mentioned that the fruits are reported to be poisonous and the juice of the bark and leaves has been used for poisoning fish. *Chickrassia tabularis* (Sin. Hulanhik) is found growing wild in the Central Province. TRIMEN mentions that the carved pillars of the old Audience Hall in Kandy are made of this wood.

C. D

KAPOK.

Some years ago the present writer was told of a wonderful substance, the virtues of which were such as to rob the sea of half its terrors; and this not because the substance—called Kapok—was suitable for internal application, but because—it was alleged—if made into a belt or pair of braces, it would impart such buoyancy to the wearer that were he shipwrecked he would float securely in the wildest sea. The origin and nature of this lightsome material were not divulged, and the writer, on his voyages, forgot to provide himself with a buoyant belt of mysterious Kapok, and continued to put a hesitating trust in the somewhat dilapidated canvas-covered cork belts which hang up in dark corners of the steamships. Now, thanks to the Philippine Bureau of Agriculture, from which Nature can keep no secrets, the mystery of Kapok is revealed to me, and I recognise it as a long-familiar friend. I recall the tall and slender tiered trees of Eriodendron anfractuosum—more properly known as Ceiba pentandra—the so-called Cotton tree of the Eastern tropics. I remember that this tree is at certain seasons one of the most striking objects in the landscape of Ceylon, and that it owes its prominence to its deciduous habit. Unlike the great majority of tropical trees, whose leaves ignore the changing seasons, the Cotton tree is deciduous, and during the dry season it stands forth leafless, whilst its neighbours are in full foliage. I recollect the thick, pointed pods which it bears, and that the seeds within the pods are covered with fine, silky hairs derived from the inner fruit cells. These hairs are Kapok. Each hair is composed of a single cell with a thin wall and large central air-space, and microscopic examination reveals the source of its wonderful buoyancy. Each fibre consists of one-tenth solid elastic wall and nine-tenths air, so that a belt made of Kapok is an air cushion of most cunning natural contrivance. In future when I travel to the East I shall wear a belt of Kapok, if only for sentimental reasons—at least, I shall do so unless the price, which is rising constantly, gets beyond my reach. Fortunately, Java, which has hitherto had almost a monopoly of this material, is not the sole source of Kapok, for the tree is widespread throughout the Eastern tropics, and the energetic personnel of the Bureau of Agriculture in the Philippines is urging its systematic cultivation and exploitation. Needless to say the uses of Kapok are numerous and increasing. For filling cushions, sofas and mattresses it is without rival, for such is its lightness that a very little goes a long way. It stands at the head of the list of filling materials, and to stuff a mattress it requires one-third less of Kapok than of Alpine grass, horse-hair, straw or such-like materials. Until recently Kapok was held to be too brittle for textile purposes, but difficulties in the way of spinning have been overcome, and Kapok yarn is now an accomplished fact. It should make admirable shirts for aviators. To those who are concerned with developing the resources of our tropical possessions the virtues and promise of Kapok, and the Bulletin (No. 26) which extols these virtues, are to be commended.—"Traveller" in the Gardeners' Chronicle.

COCONUT NOTES.

In reply to a correspondent Mr. A. Bruce, Assistant to the Government Agricultural Chemist, recommends for purposes of detecting adulteration of coconut oil the Butyro refractometer which can be obtained at a cost of about £16 to £18. The adulteration is shown by a shadow on a scale which is regulated by a pure sample of coconut oil.

A sample of oil from the Kandy market suspected to be adulterated has been submitted for examination by the Government Agricultural Chemist.

The Secretary of the Low-country Products Association has kindly communicated the results of enquiries made by his Association :—

"The alleged adulteration has been carried on by petty traders for a short time. This was when the price of coconut oil was about Rs. 30·00 per cwt. An adulterant must of necessity be inferior in quality or value, and in this case the price of the groundnut oil delivered in Colombo was Rs. 26·00, and Rs. 27·00 per cwt. It is we believe generally sold at higher prices, but the good crops of groundnuts in South India resulted in a slight drop in price of the oil. When, therefore, the price of coconut oil falls or the price of groundnuts rises there is no advantage in adulteration. On the whole there does not seem to be any cause for alarm (1) that adulteration, if it can be so called, with groundnut oil, exists to any great extent, or (2) that it is now being carried on with injury to trade. It is also reported that another inferior mineral oil clear in appearance and compatible in mixture with coconut oil is being used by Galle traders in their retail vend to plumbago mine-owners who use it for lighting the mines. The mixture appears to make little difference in the analysis of the oil. The open enquiry by your Society into this question of adulteration has deterred these traders from importing either adulterant. However, my Association will keep a close watch on any further developments and report to your Society whether any protective steps should be taken or a prohibitive import duty is necessary to keep objectionable oils out. So far as we are able to gather, no groundnut oil is imported for purposes of food in Ceylon."

Reports of damage by coconut beetles are common, particularly from new areas surrounded by jungle as at Topawewa, where the position of the planter is made desperate by reason of the depredations of the red and black beetle pests. In the Eastern Province the trouble has always been more or less acute, but whether it has actually increased since the great destruction of palms by the last cyclone is not definitely known. A planter writing from Batticaloa in January reports that 4,000 beetles were killed on one estate last December.

Owing no doubt to the importance to which the coconut industry has now attained a mass of information on the pests and diseases of the coconut palm has recently been published in different quarters.

The discovery of a fungus inimical to the beetle pest is reported and enquiries have already been received about this from local planters. On reference to the Government Entomologist that officer reports that its efficacy has not been demonstrated as yet, and that we should await further investigation.

ROOT SECRETION.

It has long been a matter of dispute whether roots secrete substances inimical to their own growth. Recent experiments appear to show that roots do excrete such toxic substances, but the objection has been urged against these experiments that they did not take into account the action of such micro-organisms as might have been present. Mons. Milliard has directed his attention to this problem, and his recent experiments, described in the *Bulletin* of the Botanical Society of France (vol. 60, 5, 1913), which were carried out with seeds germinated under aseptic conditions, indicate that toxic secretion by roots does occur. The experiments were made with Peas grown in water cultures, and showed that when the solution which had been used for one set of Peas was employed for another, the latter made extremely poor growth, the main roots remained short, and the growth of lateral roots was arrested.—Gardeners' Chronicle.

COTTON.

Advises received from MESSRS. FREUDENBERG & Co., local agents of the British Cotton Growing Association, are to the effect that the two grades of Allens' long staple cotton raised at Ambalantota (Hambantota district) under the supervision of MR. N. M. JAYASURIYA, Agricultural Instructor, fetched $9\frac{1}{2}d$ per lb. and $7\frac{1}{2}d$ per lb. respectively. The seed cotton was ginned at MESSRS. FREUDENBERG & Co.'s ginnery at their Kotahena Mills and the lint only sent to Liverpool. The cotton is reported on as approximating to Sea Island in silkiness. The values quoted were realised when American middling was at 7·35*d*.

This season between 30 and 40 acres have been planted by chena cultivators in the Hambantota district through the initiative of the Assistant Government Agent.

A quantity of seed was also supplied to the Government Agent, Eastern Province, but the return of land under cultivation has not yet come to hand. The presence of an Instructor with an Indian experience in this province should help to push cotton cultivation.

In the Kurunegala district Allens' long staple is again being tried at Hettipola and Balalla and for the first time at Nikaweratiya.

TAPPING OF NIPA PALMS FOR TODDY.

The occurrence of the Nipa palm (Sinh. Ginpol) in the backwaters of our rivers on the South-west Coast, and the fact that a great industry in tapping the palm for "toddy" exists in the Philippines led to the experimental tapping of a few trees by the Mudaliyar of Pasdum Korale at the instance of the Agricultural Society, but without satisfactory results.

It would appear, however, that the method adopted was at fault, the usual method of tapping the coconut and kitul having been followed.

In the case of the nipa the fruit should be allowed to form before the tree is attacked, and the stalk should be cut across near the top, usually just below the fruit. Each day a thin slice is removed as in the case of the coconut spathe to induce a flow of sap.

RAINFALL FOR DECEMBER, 1913.

Place	1912	1913	Place	1912	1913
	in.	in.		in.	in.
Colombo	5·72	12·12	Kurunegala	8·57	13·18
Kandy	13·91	18·64	Batticaloa	14·70	35·27
Galle	12·35	5·57	Ratnapura	10·89	18·65
Jaffna	6·11	11·33	Badulla	14·94	23·92
Anuradhapura	3·20	11·41	Nuwara Eliya	12·91	24·02

N.B.—There were no readings taken at Galle from the 16th to the 19th inclusive.

BUFFALO MILK.

In the Philippine Journal of Science for June last, Mr. Dovey, of the Chemical Laboratory, Bureau of Science, discusses the composition of buffalo milk based on work undertaken with a view to fix a standard for milk sold for public consumption.

As the result of many examinations it was found that whereas in cow milk the fat is approximately 30% of the total solids it reaches nearly 50 in the buffalo. The ratio of lactose, protein, and ash also differs greatly from that in cow milk, being 5, 7, and 1, respectively. This agrees approximately with the results obtained by Mann and Meggit in India, but differs from those obtained by Peppel and Richard with Egyptian buffalo milk.

The precentage of lactose is almost the same in both buffalo and cow milk, though the protein is much higher in the former.

The ratio of casein to albumen is in cow milk 1. 7·5 and in the Philippine buffalo 1·10 (in the Egyptian buffalo 1. 5·5).

The total mineral matter shows the same ratio to solids not fat in cow and buffalo milk, but phosphoric acid and calcium is present in large proportion.

It is suggested that as the principal ash constituents are fairly constant the determination of phosphoric acid would indicate adulteration with water if practised.

The average composition of the milk from 105 buffaloes was found to be as follows:—

Fat	10·44 %
Total Solids	21·42 „
Solids not fat	11·28 „
Water	78·58 „

It is recommended in view of the great variations shown by different samples of buffalo milk that a minimum of 8·5% of solids not fat and 8% of milk fat be adopted as the standard under the Food and Drugs Act.

C. D.

RICE CULTIVATION IN THE UNITED STATES.

In the United States of North America, rice cultivation is limited to the South Atlantic and Gulf States, where in some districts it is the principal cereal crop. Since its introduction in 1694 rice has been cultivated on an increasingly large scale until in 1912 some 723,000 acres of rice were harvested and the production amounted to 25,054,000 bushels. The principal producing States are Louisiana, Texas, and Arkansas, the first-named being the most important. The great development of rice culture in Louisiana is largely due to the opening up of prairie land in the south-west part of the State, and to the adoption of a system of irrigation and culture which has made it possible to utilise modern machinery for the crop. The principal varieties of lowland rice cultivated are, the "gold seed" of the Carolinas, so called from the colour of the husk when ripe; the Honduras and Japan varieties. The "gold seed" variety takes high rank amongst cultivated rices of the world for

quality of grain and for yield. The Honduras variety, originally introduced from Mexico, is similar in form of grain and habit of growth to the "gold seed" variety, but the quality is not so good. The Japan varieties were introduced on account of their superior milling qualities, one of them, known as "kiushu," yielding from 90 to 95 per cent. of "head-rice" on milling as against an average of about 40 per cent. by the Honduras and Carolina varieties.

SOILS.

There are four principal kinds of rice land in the United States : they are (1) *delta lands* situated sufficiently remote from the sea to be free from flooding by salt water; (2) *inland marshes*, that can be conveniently drained and economically irrigated ; (3) *alluvial land*, bordering fresh water rivers ; and (4) *prairie lands*, practically level areas that can be converted into rice lands with comparatively little expense.

The type of soil most favoured in the United States is a rich clay-loam, containing about 50 per cent. of clay. The rich drift soils of Louisiana and Texas prairies have a clay subsoil that is retentive of the water essential to the rice crop, and some of these soils are so stiff that they cannot be ploughed until softened by flooding. When properly drained they admit of the complete withdrawal of the surface water for ripening the crop, after which they become sufficiently firm to allow of the use of a team of horses and heavy machines for harvesting. Alluvial lands, such as those along the Mississippi river in Louisiana, which have no hard, compact subsoil, cannot be drained in the same way and will not admit of the use of heavy machinery.

Gravelly and sandy soils have not, as a rule, been found suitable for the rice crop, as their physical properties will not allow them to retain the necessary amount of surface water ; peaty soils have also been found unsuitable.

PREPARATION OF THE SOIL.

This consists in spring ploughing shortly before planting time. Shallow ploughing to a depth of not more than 3 in. is practised by some growers on the grounds that the rice plant is surface-rooting and therefore does not require a deep-rooting medium, and also that deep ploughing renders the soil too porous, Deeper ploughing is, however, practised in many cases with good results. Where the subsoil is alkaline, deep ploughing is done in the autumn, so that harmful salts are washed away from the surface by the winter rains. The surface soil is brought to a good state of tilth after ploughing by the use of the disk harrow and by rolling. Good drainage is provided by means of open ditches, which in all cases are made deeper than the furrows, and the rain drains are at least 3 ft. deep.

SOWING.

In most cases sowing is done by April 20, but the season varies according to locality, and may be as late as the middle of May, or as early as the middle of March. It usually takes place as early as possible after the spring ploughing is completed. The amount sown per acre varies from 55-80 lb., according to the variety and method of sowing. The grain is sown either broadcast or in drills, the latter method giving the best results. After sowing the land is rolled and harrowed, and sufficient water is admitted from the irrigation supply to saturate the soil and ensure the germination of the seed. In the event of the soil being sufficiently moist to effect germination, the irrigation at this period is omitted. As in the East, the seed is sometimes sprouted by soaking it in water before sowing—a practise not recommended as, unless the soil in which sprouted seed is sown is sufficiently moist to continue the growth, failure frequently results.

FLOODING.

The practice varies considerably in different localities and is naturally influenced by the rainfall. Generally it is as follows :—Water is admitted to the fields as soon as the seedlings are a few inches above the ground, and the

depth of the standing water is increased as rapidly as growth permits until it is sufficient to destroy weeds. As far as possible a uniform depth over the whole field is maintained, as this conduces to the uniform maturing of the crop, and there is a regular intake and overflow of water in order to prevent stagnation. Water is frequently kept on the fields at a greater depth than is essential for the welfare of the rice crop in order to keep down weeds, but it has been found that "tillering" is greatly encouraged, and the yield thereby largely increased, by keeping the soil saturated with water but not allowing sufficient to stand on the surface until after the plants have fully "tillered."

In South Carolina the practice above described is somewhat modified. The sowing is made in well pulverised soil in trenches 12 in. apart and from 2 to 3 in. deep, opened by 4-in. hoes at right-angles to the drains. The grain is usually covered with soil, but in some cases the seed is dipped in clayed water before sowing, and is left uncovered, sufficient clay adhering to prevent it floating away. The water is admitted to the fields as soon as sowing is completed, and is allowed to stand for from four to six days until the grain has sprouted, when it is withdrawn. A second watering is given when the blade is a few inches high, and this is also withdrawn. A third watering is given after the seedlings have formed two leaves; at first the water is allowed to cover the plants completely, being generally from 10 to 12 in. deep, but this depth is reduced until it stands at about 6 in., at which it is kept for from 20 to 30 days, when it is withdrawn and the fields allowed to become dry. As soon as the soil is in a suitable condition it is hoed and weeds removed, and after the hoeing it remains without irrigation until "jointing" commences. A second hoeing is then given, after which water is again let on and is allowed to remain until about eight days before harvest, being changed at least once a week to prevent stagnation.

HARVESTING.

Rice is cut when the straw has just commenced to turn yellow, and is not allowed to stand until the stems have turned yellow to the top. Where fields are of a sufficiently large area and the soil of the requisite firmness to admit of their use, modern reaping machines or self-binders are employed to harvest the crop. Where the use of machines is not practicable the sickle is usually employed.

The straw is cut at about 6 to 12 in. from the ground, and the heads of rice are laid on the stubble to prevent contact with the wet soil. After remaining for a day to "cure" they are made up into bundles and stood in small stacks of "shocks." The "shocking" is done on dry ground, and care is taken to prevent exposure of the heads of rice to sun or rain by capping the shock with bundles, the heads of which are placed on the north side. Exposure to sun and rain is held responsible for sun-cracked kernels which, when present in a sample, greatly reduce its milling qualities and consequently its market value. Judgment is required to determine when the "curing" is complete, but in favourable weather a period of from 10 to 12 days after cutting suffices to harden the grain and dry the straw. Stacking is sometimes practised, but is not considered essential, and the grain is usually thrashed after being dried in the shock.

THRASHING.

This is now largely done by the use of the steam thrasher, as in the case of other cereals. Care is essential, in dealing with rice, to prevent breakage of the grain. Before being put up into sacks the grain is spread upon a floor and dried, as if sacked whilst damp the colour of the grain and its milling qualities deteriorate.

The average yield is from 8 to 12 barrels=1,296 to 1,944 lb. of "rough rice" per acre, but on good lands properly managed the yield may be much higher, as on the lowlands of the Mississippi, where 30 barrels (= 4,860 lb.) per acre have been recorded.—IMP. INST. BULLETIN.

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Latest Monthly Prices Current.

		QUALITY.	QUOTATIONS.
ALOES, Socotrine	cwt.	Fair to fine	40/ a 50/
Zanzibar & Hepatic	,,	Common to good	40/ a 70/
ARROWROOT (Natal)	lb.	Fair to fine	6½d a 6¾d
BEES' WAX	cwt.		
Zanzibar Yellow	,,	Slightly drossy to fair	£7 15/a£8
East Indian, bleached	,,	Fair to good	£8 10/a £8 15/
,, unbleached	,,	Dark to good genuine	£6 10/ a £7 2/6
Madagascar	,,	Dark to good palish	£7 17/6a £ 8 5/
CAMPHOR, Japan	lb.	Refined	1/4½ a 1/6¼
China	cwt.	Fair average quality	155/
CARDAMOMS, Tuticorin		Good to fine bold	6/ a 6/3
	per lb	Middling lean	5/2 a 5/7
Malabar, Tellicherry	,,	Good to fine bold	6/ a 6/3
Calicut	,,	Brownish	5/2 a 5/8
Mangalore	,,	Med Brown to good bold	5/3 a 6/6
Ceylon, Mysore	,,	Small fair to fine plump	4/ a 6/2
Malabar	,,	Fair to good	3/6 a 3/8
Seeds, E. I & Ceylon	,,	Fair to good	4/6 a 5/
Ceylon "Long Wild"	,,	Shelly to good	2/3 a 4/3
CASTOR OIL, Calcutta	,,	Good 2nds	4½d
CHILLIES, Zanzibar	cwt.	Dull to fine bright	37/6 a 45/
Japan	,,	Fair bright small	45/
CINCHONA BARK.—Ceylon	lb.	Crown, Renewed	3⅜d a 7 d
		Org. Stem	2d a 6d
		Red Org. Stem	1⅜ d a 4¼d
		Renewed	3d a 5¼d
		Root	1⅝d a 4d
CINNAMON, Ceylon	1sts.	Good to fine quill	1/3 a 1/7
per lb.	2nds.	,, ,,	1/2 a 1/6
	3rds.	,, ,,	1/1 a 1/5
	4ths.	,, ,,	1/ a 1/3
Chips, &c.,		Fair to fine bold	2d a 4d
CLOVES, Penang	lb.	Dull to fine bright pkd.	1/1 a 1/3
Amboyna	,,	Dull to fine	10d a 10½d
Zanzibar	,,	Fair and fine bright	5¾d a 6¼d
Madagascar	,,	Fair	7d
Stems	,,	Fair	3d
COFFEE			
Ceylon Plantation	cwt.	Medium to bold	Nominal
Native		Good ordinary	50/a 55/
Liberian	,,	Fair to bold	63/a 80/
COCOA, Ceylon Plant.	,,	Special Marks	79/ a 87/6
		Red to good	73/ a 78/6
Native Estate	,,	Ordinary to red	42/ a 68/
Java and Celebes	,,	Small to good red	30s a 93s
COLOMBO ROOT	,,	Middling to good	12/ 6a 21/
CROTON SEEDS, sifted	,,	Dull to fair	57/6 a 60/ nom.
CUBEBS	,, ,,	Ord. stalky to good	135/ a 165/
GINGER, Bengal, rough	,,	Fair	19/
Calicut, Cut A	,,	Medium to fine bold	60/ a 75/
B & C	,,	Small and medium	36/ a 60/
Cochin, Rough	,,	Common to fine bold	22 6 a 30/
		Small and D's	22.6
Japan	,,	Unsplit	23/
GUM AMMONIACUM	,,	Ord. Blocky to fair clean	40/s a 72s 6d
ANIMI, Zanzibar		Pale and amber, ster. srts	£14 10/a £16 10
	,,	,, ,, little red	£11 a £12
	,,	Bean and Pea size ditto	70/ a £11
	,,	Fair to good red sorts	£8 10/ a £10 10
	,,	Med. and bold glassy sorts	£5 a £7
Madagascar	,,	Fair to good palish	£4 a £8
	,, ,,	red	£4 a £7
ARABIC, E. I. & Aden	,,	Ordinary to good pale	26/ a 30/
Turkey sorts	,,		32/ a 55/
Ghatti	,,	Sorts to fine pale	18 6 a 30/ nom.
Kurrachee	,,	Reddish to good pale	25 a 30s nom.
Madras	,,	Dark to fine pale	22/6 a 29.6 nom
ASSAFŒTIDA	,,	Clean fr. to gd. almonds	£7 a £8
		com. stony to good block	40s a £5 12/6
KINO	lb.	Fair to fine bright	6d a 1/5
MYRRH, Aden sorts	cwt.	Middling to good	65/ a 75/
Somali	,,	,, ,,	52s 6d a 57s 6d
OLIBANUM, drop	,,	Good to fine white	45s a 50s
	,,	Middling to fair	35s a 40s
pickings	,,	Low to good pale	15/ a 27/6
siftings	,,	Slightly foul to fine	18 s a 21s
INDIA RUBBER	lb.	Fine Para smoked & sheets	2/5¼
		Crepe ordinary to fine	2/5
Ceylon, Straits,	,,	Fine Block	2 4¾
Malay Straits, etc.	,,	Scrap fair to fine	1/10 a 1/11
	,,	Plantation	1/11
Assam	,,	Fair 11 to ord. red No. 1.	1/4 a 1/6
	,,	,, ,, ,,	1/2 a 1/4
Rangoon	,,		
	,,		

		QUALITY.	QUOTATIONS.
INDIARUBBER	lb.		
Borneo	,,	Common to good	9d a 1/3
Java	,,	Good to fine red	1/4 a 1/6
Penang	,,	Low white to prime red	9 d a 1/4
Mozambique	,,	Fair to fine red ball	1/10 a 2/3
	,,	Sausage, fair to good	1/9 a 2/2
Nyassaland	,,	Fair to fine ball	1/9 a 2/1
Madagascar	,,	Fr. to fine pinky & white	1/6 a 1/8
	,,	Majunga & blk coated	1/ a 1/3
	,,	Niggers, low to good	6d a 1/6
New Guinea	,,	Ordinary to fine ball	1/4 a 1/7
INDIGO, E.I. Bengal	,,	Shipping mid to gd. violet	3s 3d a 3s 8d
	,,	Consuming mid. to gd.	2s 9d a 3s 2d
	,,	Ordinary to middling	2s 4d a 2s 9d
	,,	Mid. to good Kurpah	1s 11d a 2s 5d
	,,	Low to ordinary	1s 6d a 1s 9d
	,,	Mid. to fine Madras	1/11 a 2/9
MACE, Bombay & Penang		Pale reddish to fine	2/4 a 2/6
	per lb.	Ordinary to fair	2/ a 2/2
Java		,, good pale	2/ 1a 2/4
Bombay		Wild	1/
NUTMEGS,—	lb.		
Singapore & Penang	,,	64's to 57 s	9½d a 10½d
		80's	7½d
		110's	6½d
NUTS, ARECA	cwt.	Ordinary to fair fresh	17/6 a20/
NUX VOMICA, Cochin		Ordinary to good	10/ a 12/6
per cwt. Bengal		,, ,,	9/3
Madras		,, ,,	9/3 a9/6
OIL OF ANISEED	lb.	Fair merchantable	6/
CASSIA	,,	According to analysis	2/10 a 3/2
LEMONGRASS	oz.	Good flavour & colour	2½d
NUTMEG	,,	Dingy to white	1½d a 1⅞d
CINNAMON	,,	Ordinary to fair sweet	3½d a 1s 5d
CITRONELLE	lb.	Bright & good flavour	1/7½
ORCHELLA WEED—Ceylon	cwt.	Fair	15/
Madagascar	,,	Fair	15/
Zanzibar	,,	Fair	15/
PEPPER—(Black)	lb.	Fair	5⅛d a 5⅛d
Alleppy & Tellicherry		Fair to fine bold heavy	5⅛d a 5⅜d
Ceylon	,,	Fair	5d
Singapore	...	Dull to fine	5d a 5⅛d
Acheen & W. C. Penang		Fair to fine	8⅜d a8¾d
(White) Singapore	,,	Fair	8⅜d
Siam	,,	Fair	7⅜d
Penang	,,	Fair	9d
Muntok	,,	Ordinary to good	2/ a 3/6
RHUBARB, Shenzi	,,	Ordinary to good	1/10 a 3/3
Canton	,,	Fair to fine flat	1/ a 1/1
High Dried	,,	Dark to fair round	9 d a 11d
SAGO, PEARL, large--cwt		Fair to fine	18/
medium	..	,, ,,	17/
small	..	,, ,,	13/ a 14/
Flour	..	Good pinky to white	10 a 11/
SEFDLAC	cwt.	Ordinary to gd. soluble	65/ a 85/
SENNA, Tinnevelly	lb.	Good to fine bold green	5d a 8½d
		Fair greenish	3 d a 4½d
		Common specky & small	1¼ d a 2½d
SHELLS, M. o' PEARL—		Small to bold	100/ a £7 nom.
Egyptian	cwt.	,, ,,	60/ a £7 nom
Bombay	,,	Chicken to bold	£10 a £14
Mergui	,,	Fair to good	£9 a £14 2/6
Manilla	,,	Sorts	82/6
Banda	,,	Small to large	57/6 a 85/
Green Snail	,,	Trimmed selected small	
Japan Ear	,,	to bold	41/ a £6 10/
TAMARINDS, Calcutta		Mid to fine bl'k not stony	14/ a 15/
per cwt. Madras		Inferior to good	6/ a 10/
TORTOISESHELL—			
Zanzibar, & Bombay	lb.	Small to bold	13/ 6 a 26/
		Pickings	7/ a 15/6
TURMERIC, Bengal	cwt.	Fair	12/
Madras	,,	Finger fair to fine bold	14/6 a 16/6
Do.	,,	Bulbs ,, ,, bright	12/ a 13
Cochin	,,	Finger fair	14/ nom
		Bulbs ,,	12/
VANILLOES	lb.		
Mauritius ...	1sts.	Gd. crystallized 3½a 8½a in.	10/ a 15/
Madagascar ...	2nds.	Foxy & reddish 3½a ,,	9/6 a 12/
Seychelles ...	3rds.	Lean and inferior	9/3 a 10/
VERMILLION ...	lbs.	Fine, pure, bright	2/9
WAX, Japan squares	cwts.	Good white hard	55/

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Superintendent of Botanic Gardens, Ceylon.

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